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THE PRACTICAL TEACHER

DR. HUGH CAMPBELL,
THE NEW PRESIDENT OF THE E.I.S.

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OF THE
OCTOBER NUMBER.

SCHOOL METHOD
AND THE
EDUCATION DEPARTMENT:
Mr. SADLER'S
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SOME HUMOURS OF AN INTERNATIONAL FEREINKURS.

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THE PRACTICAL TEACHER

A MONTHLY MAGAZINE AND REVIEW FOR THE SCHOOL-ROOM AND THE STUDY

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SCHOOL METHOD AND THE EDUCATION DEPARTMENT:

MR. SADLER'S FIRST VOLUME OF SPECIAL REPORTS.

WHEN Mr. Acland, during his term of office as Minister of Education, caused Mr. Michael E. Sadler to be gazetted Director of Special Inquiries and Reports, he did a very bold thing; for not only political foes but many amongst the friends of that educational enthusiast were of opinion that this appointment was unnecessary, and likely to be productive of little, if any, good to education. Since then the Director and his small staff have been working just as quietly as effectively, and already Mr. Sadler has justified not only the existence of his office, but also of himself as the ideal head thereof. This was the firstling of our thoughts as we glanced through the bulky volume which, under the above title, was early in August issued to us by the Education Department. It is not too much to say that never has so admirable a work on education been sent forth from the Department over which Sir John Gorst presides. The volume is a bulky tome of upwards of 732 pages. It comprises twenty-six chapters, and is almost encyclopaedic in character, as will be seen from what follows.

We can give but little space to each of these twenty-six chapters; and alas! many numbers of the PRACTICAL TEACHER would not suffice to contain a tithe of all that one would fain say in commendation or otherwise of these special reports.

ART. 1 provides under ten heads an excellent **summary of the progress of elementary education since the advent of School Boards in 1870.** With this part of the volume our readers are already in great measure familiar, and we may dismiss it with a compliment to Mr. Sadler for the grasp and lucidity that are conspicuous in this statistical sketch of primary education during the last three decades.

ART. 2.—**English Students in French Training Colleges.**—This refers to a most enticing scheme whereby English students in training, and others, may obtain a sound knowledge of foreign school systems at the same time that they learn the foreign language at first hand. Miss Manley, the Principal of Stockwell, gives an account of the experiences of nine of her students who had acted, or were acting, as *répétitrices* in French Training Colleges. The girls chosen are charged about £16 per annum, in addition to which they have to spend from six to ten hours per week in reading English with the French students and in conversation exercises. Miss Williams, the Official Representative of the French Ministry of Public Instruction in this matter, also supplies a paper on the same subject, and Miss M. L. Benton, who has herself spent 2½ years in the capacity of *répétitrice* in three French Training Colleges, details her experiences in a very interesting sketch. Then, as to the men, Principal Withers writes of the six 'triarians,' as the third year men are termed at Isleworth, who have held these travelling studentships, one of whom, Mr. G. N. Wheeldon, who went to Weimar, recites the complement to Miss Benton's memorandum respecting his life at Weimar. This embraces a sketch of the teaching of Geography in the Elementary Schools of Saxe-Weimar, concerning which Mr. Wheeldon, who certainly profits professionally as well as from a linguistic point of view, says, in effect, that the German children as a result of going through their Geography course get less in the way of knowledge than does the English schoolboy or girl, but infinitely more of training in observation and in the expression of the results of that observation in grammatical language. Nothing could more eloquently testify to the value of these sojournings in strange lands than this student's memorandum.

ART. 3 is from the pen of Mr. Seth Coward, and should be read by all who wish to be informed concerning the what and how of the **Alternative Syllabus in Drawing,** which the Head Master of the Alma Road Board School has had the courage, not to say the temerity, to adopt. Until examination in Drawing is replaced by inspection, until 'the question is not whether the child is producing good drawings, but whether it is developing its faculties,' as Spencer puts it, and finally until much more money is given in the way of Drawing grants, we fear that few will be able to emulate the enthusiasm of Mr. Coward, whose article is instinct with intelligent anxiety for the use of the brush as a means to better art and better training. Appended are some excellent examples of the work of the hands of the Alma Road boys in the direction of brush work and design.

ART. 4.—**The A B C of Drawing.**—This is a very peculiar essay on Drawing, written in a mystical style which does not often allow one to judge of the real aim of the writer. Still, one or two things are clearly apparent, and of these, by far the most important to the writer, is that he has found **a new line element**, and we believe nobody will begrudge him the intense satisfaction af-

forded him by this belated discovery. The new line element is the quadrant of an ellipse. The printer seems to have been dazzled by the brilliance of Mr. Cooke's style as well as by the perfervour of his imagination, for he calls the great discovery 'The quadrant of the eclipse,' which, alas and alack-a-day 'has no name,' although it is the foundation line of the new Alternative Syllabus, and which naturally is almost as dear to Mr. Cooke's heart as the new line element, for to a great extent he is responsible for the existence of both. While agreeing with much that Mr. Cooke has to say, and whilst acknowledging the manifest attempts at completeness in respect to both the pedagogy and the psychology of the sketch, we are bound to say that in our opinion the zeal of Mr. Cooke has run away with his discretion, the result being an enigmatical advocacy of the Alternative Syllabus, which smacks of profusion, effusion, and confusion, and in no way answers the objections brought by practical teachers against the more rational teaching of Drawing; which questions of expense, of uncertainty, of training, and of administration, debar teachers from introducing into their schools. If Mr. Cooke had said (1) **abolish the merit grant and the Drawing examination,** (2) **simplify the Alternative Syllabus, and** (3) **give more money to meet the increased expenditure inseparable from a change from the old to the new,** we venture to aver that he would have done more to advance the cause so evidently and so creditably dear to him, than he has done in thus mystically holding forth on his grand discovery of the third elemental line. This may be Philistinism to Mr. Cooke, but to teachers of experience it will, we opine, spell plain commonsense.

ARTS. 5 and 6.—**Domestic Economy Teaching in England and Technical Education of Girls.**—The thoroughness and practicability of these two articles is admirable in a high degree; Needlework, Cookery, Laundry, and Housewifery, are exhaustively treated of, so that we become acquainted with what is being done by all the various teaching agencies to disseminate not only sound science and theory in respect to all that appertains to the proper conduct of home, but also, and more especially, a practical acquaintance with the performance of the operations to which these domestic sciences have reference. Domestic Economy as a specific in urban and in rural districts, Domestic Science under the mixed rule of the London School Board, the City and Guilds of London Technical Institute, and the Worshipful Company of Drapers, whereby Housewifery came to life as a Code subject, Domestic Science in the Evening Continuation School, in the Polytechnic, under the County Councils and the Secondary and Organised Science School—all this and more is told with a completeness and a conciseness (backed up too by needful statistics) that it would be difficult to improve upon. It is satisfactory to know that the proper bringing up of the housewife is attracting so much attention. It is distinctly good to learn that our girls are being taught how to go marketing, and in the best way, viz., by going. We rejoice that even in districts remote from populous centres, well qualified enthusiastic teachers are frequently at hand to teach the homely art and science of housekeeping, to the end that they and theirs may not only be 'passing rich,' but also passing happy and passing healthy on less than 'forty pounds a year.' It is clear from these two articles that the right way has been found in this connection, and all that is needed is the encouragement of the various agencies engaged in this good work, and the extension of their work to the delight of Mrs. Pillow and Miss Cooper, who have so well done their part of this report. There is but one thing needful, and that is not likely to come yet. We refer to simple teaching in the management and rearing of children. It is now some years since we were delighted with the housewifery operations of a class of London Board School girls under the guidance of Mrs. Lord, whose name we shall always call to mind when housewifery and domestic science are mentioned, for she has done so much for this movement that it would be a graceful recognition of good work done, as well as a means to more 'good copy,' if Mr. Sadler were to ask that pioneer to recount her experiences in the next volume of reports.

ART. 7.—**The Secondary Day School at the Battersea Polytechnics.**—Mr. Sidney Wells contributes an account of the Organised Science School, or as it must now be called the School of Science, which is flourishing like the green bay tree at the Battersea Polytechnic. The school is a mixed one, much to its internal good—as indeed many of us have already found in our mixed schools and classes—and affords excellent preparation for the future skilled artisan or foreman of a commercial establishment. By way of preface, Mr. Wells gives an interesting sketch of the work of his Institute, but, as in our December number we are giving a full illustrated article on the excellent institution in Battersea Park Road, we shall content ourselves with complimenting the worthy Principal upon the vividness of his description of the institution he loves so well.

ARTS. 8 and 9.—**The History of the Irish System of Elementary Education and the National System of Education in Ireland.**—Beginning with 1537, when the Irish Parliament established parochial schools, the history of the Irish educational system down to 1897 is in these two memoranda set out. Mr. Sadler also adds tables 'showing the reciprocal influence of Irish on English and of English on Irish education.' It may interest the Director to know that the uppermost thought in our mind, after a careful perusal of this part of his first volume, was 'how does it happen that this reciprocal influence should be so weak in some of the most vital particulars?' Why, for example, should pensions be good for Ireland, and not equally so for England? Why should free choice as to school books be the right of the English teacher, but only the hope of the Irish? Why should compulsion run in Albion and not in Erin? Why should examination plague the Celt, whereas his brother Saxon is trusted and inspected? Why should *free* in one set of schools read *fee* in the other? The reciprocity has evidently been somewhat blind, and more of this, according to one the privileges of the other, must take place before reciprocity can be regarded as the good fairy of the teacher, whether Celt or Saxon. It needs no prophet to foretell that this will be the case, and these reports may do something towards the desired end in emphasizing the fact that the desiderata of the one island are the accomplished facts of the other. If English education has suffered much from the religious difficulty, it certainly must be conceded that the sufferings of Ireland in this have been, and still are, greater. This is the tale told by Mr. Sadler's report, and it is pitiable to see education thus the sport of contending religious factions.

How the National Board of Education came to be appointed, and how it has dealt, and is dealing, with the 'four salient features' of its system set out below, we have no space to relate, but must content ourselves with the simple statement that the Director deals with the subject in a manner to be understanded of the vulgar.

Four salient features of the National Board System:—

(*a*) Its attempted solution of the religious difficulty.
(*b*) Its arrangements for paying part of the teacher's salary.
(*c*) Its provision of text-books.
(*d*) Its establishment of a Training College and of model schools.

The reason for some alteration under (*c*) was pretty evident from what follows. In 1824 the Royal Commission printed a list of books used in the schools situated in Donegal, Kildare, Galway, and Kerry. Besides religious works, the names of over 300 works of entertainment are quoted. They include 'Tristram Shandy,' 'Dr. Faustus and the Devil,' 'Gil Blas,' 'Female Adventurers,' 'The Wonderful Advantages of Venturing in the Lottery,' 'Peregrine Pickle,' 'The Garden of Love,' 'The Pleasant Art of Money-Catching,' 'Women as They Are,' 'The Feats of Astrologers,' 'Rousseau's Letters,' 'Joseph Andrews' and 'Nocturnal Revels.' . . . Every child brought to school the book furnished by the domestic library, and in his turn read from it to the teacher. One might read the Bible, another the adventures of a highwayman, the third a loose romance.' The Board met this difficulty by printing certain books which alone could be used. And, by way of compensation for depriving the workman of the right of choosing his own tools, the books are supplied at a reduced price. Far better would it have been to have sent adrift the teacher who failed to choose fit books, and to leave 'teachers and managers to select any book, by whomsoever published, that had nothing objectionable about it, and, from a pedagogic standpoint, was not bad as a school book.' There is much injustice to Ireland in its system of education, as Messrs. Sadler and Kedington—whether wittingly or no—plainly show.

ART. 10.—**Recent legislation on Elementary Education in Belgium.**—Between Belgian and English teachers there is much brotherhood, as may be seen at the conferences of the teachers of both countries. Hence the estate of the Belgian teacher cannot but interest those of this country. The history of Belgian primary education falls into three well defined periods. (1) 1842–79, (2) 1879–84, (3) 1884 to the present time. The tale unfolded by this history is that of the struggle of the clergy for the schools, a struggle in which, so far, they may claim to be successful. We may pass to the Act of 1895, the three main points of which were as follows:—(1) Regulations making religious instruction obligatory in elementary schools, and placing it under the direction of the clergy; (2) provisions for increased subsidies to private elementary schools; (3) provisions for improving the financial position of the teachers. Into these points we cannot with detail enter. It may be said, however, that the Teachers' Union was dead against the changes, the first of which places not only the religious instruction but also the teachers themselves under the heel of the clergy, and in the second place many of the clericalists themselves are of opinion that the drastic nature of the Act will call for reprisals when the Socialists—an increasingly popular body in Belgium—shall have obtained a majority,

BRITISH MUSEUM

so that here again we have education the sport of the parties, to the detriment of both teacher and taught. Hear what Mr. Beernaert, himself a Conservative and a Roman Catholic, has to say on this point:—'Songez que votre project constitue un nouveau pas en avant vers la mainmise de l'État sur l'enseignement primaire. Une autre ministère le demarquera tout à son aise. Vous aurez établi l'école confessionnelle obligatoire; ils établiront l'école irréligieuse obligatoire. Simple tour de majorité.' And to this fourth period in the history of Belgian primary education many eyes are already straining.

ART. 11.—**The Housewifery School and Classes in Belgium.**—It is pleasant to record that efficient as are Belgian housewifery schools there is really little for English educationalists to learn from them. The extension of our own system is all that is needed. With the Belgians, as with us, stress is laid upon the fact that these *écoles ménagères* aim at producing good housewives rather than exemplary domestic servants.

ART. 12.—**The French System of Higher Primary Schools.**—One of the most important questions amongst us to-day is how to deal with the School of Science, as the *ci-devant* Organised Science School must now be called. Mr. Morant has given us an excellent account of the evolution of the *écoles primaires supérieures*, which are the French prototypes of our schools of science, and here again the report will strengthen the hands of the supporters of the higher grade school, for which this country has mainly to thank the enterprise and patriotism of its primary teachers, backed up by the sagacity and foresight of the leading School Boards. The genesis of the movement was much the same in France as with us, the question being what to do with the young boy who romps through the standards. Mr. Morant supplies an analysis of the history of the movement, by glancing at which we may learn much concerning the steps in the evolution of these valued and valuable aids to the formation of the skilled worker. The schools were local, so that it is no new feature in France for two educational authorities to co-exist. The trend of the movement was to distinguish the higher primary schools from secondary schools by making the former more and more technical, the latter retaining a more literary character, as befitted their aim. In 1881 came the Free Education Act in France, and with it the inclusion of higher primary instruction in that provided gratuitously by the State. In 1888 the curriculum was fixed for the *écoles professionnelles*, while by the Act of 1886 the higher schools of a less technical and more literary character which had arisen were also included in the State system, under the name of *Écoles primaires Supérieures*.

HIGHER PRIMARY SCHOOL CURRICULUM.

(1) Applied arithmetic.
(2) The elements of practical algebraical and geometrical work.
(3) The rules of ordinary accounts and book-keeping.
(4) Elementary, natural, and physical science as applied to agriculture, manufacture, and hygiene.
(5) Geometrical, model, and ornamental drawing.
(6) The elements of common law and political economy.
(7) Elementary French history and literature.
(8) The principal epochs of general history, more especially those of modern times.
(9) Industrial and commercial history.
(10) Modern languages.
(11) Working in wood and metal for boys.
(12) Needlework, cutting out, and dressmaking for girls.

A distinct technical instruction in the local industry is the distinguishing mark of the *école professionelle*, the difference between which and the *école primaire supérieure* is in most places more nominal than real. Hence only 17 of the former schools are as yet in existence. Such as do exist are under the joint control and inspection of the Ministers of Public Instruction, and Commerce and Industry. Mr. Morant deals with the defects of this class of school, and also describes a further type of school, viz., the *École Pratique de Commerce et d'Industrie*, and finally brings us down to 1893, when a greatly increased amount of practical and technical instruction was imposed upon these schools, concluding his paper with a departmental circular explaining in detail the functions of the higher primary schools, including those above mentioned and the *écoles d'apprentissage*, which, unfortunately, is much too long for quotation. The article shows how keenly alive to the advantages of thorough technical instruction our lively neighbours across the Channel are. Its moral is that we should increase very materially our educational provision in this direction, for our necessity is still greater than theirs.

ART. 13–15.—**The Realschulen in Berlin and their bearing on modern, secondary, and commercial education, the Oberrealschulen of Prussia, with special reference to the Ober-Realschule at Charlottenburg, the Prussian Elementary School Code.**—Of all the questions that have vexed the souls of educationalists first in order, both as to importance and as to disagreement, comes the question of classics versus modern language and science. Slowly but surely the modernists are gaining ground, and the Realschulen of Germany are a witness to this truth, just as our English schools of science mark a certain progress in the assaults of the modernists upon the classicists, who must give way to the demands of the commercial and industrial classes. It was in 1859 that 'a breach was made in the primacy of the classical schools' in favour of the **Latin-less schools,** and very soon the schools above primary rank in Germany were (1) **Higher Bürgerschule,** (2) **Realschule,** (3) **Ober-Realschule,** all of which were Latin-less, and gave a six, a seven, and a nine years' course respectively, (4) **Realgymnasien.** This was a kind of compromise school, resembling the Realschule in general curriculum; but in retaining Latin they were to this extent kindred with (5) **Gymnasien,** which are the secondary classical schools, comparable with our public schools. The peculiarity of the Berlin Realschulen consists in the facts, that (1) the course is one of six years, like the Higher Bürgerschulen, and (2) there is a special arrangement whereby the teaching of French and English begins in the third and fourth classes from the bottom respectively instead of from the bottom, and fourth from the bottom, as is usual in schools of this class. The change was proposed entirely in the interests of the pupils in the primary schools, who upon passing up into the Realschule at the age of 12 or thereabouts would be able to commence the study of modern languages at a suitable age. The demand of the Berlin Magistrat was practically conceded, and now no less than a dozen of these Berlin Realschulen are in existence. The curriculum of these schools will be apparent from what follows, it being remembered that Class I. is the top and not the bottom of the school:—

Subject.	No. of hours given weekly in class, exclusive of Home Lessons.					
	VI.	V.	IV.	III.	II.	I.
Religion	3	2	2	2	2	2
Mother-tongue and narration of national and historical events	6	6	4	4	3	3
French	—	—	8	8	6	6
English	—	—	—	—	6	6
History and Geography	3	4	4	4	3	3
Mathematics	6	6	6	6	5	5
Natural History	2	2	2	2	2	—
Physics and Chemistry	—	—	—	2	2	4
Writing	3	3	—	—	—	—
Freehand	2	2	2	2	1	1
	25	25	28	30	30	30
Geometrical Drawing	—	—	—	—	2	2
Singing	2	2	2	2	2	2
Gymnastics	3	3	3	3	3	3
	30	30	33	35	37	37

The control of these schools by the State is thorough, if indirect. One of the most important of the privileges granted to a scholar who obtains the leaving certificate of a Realschule is the exemption from one of the two years of military service. A very interesting summary of the privileges attaching to the leaving certificate of the various higher schools in Prussia is given by Mr. Sadler in his Appendix. In a further chapter we learn what the Director of Special Reports saw with his own eyes during a recent visit to one of these Berlin Realschulen. 'They keep before them at every point of their work **the ideal of a liberal education.**' . . . 'The stress is laid on linguistic and literary (including religious and historical) studies, while mathematics, natural science, and drawing receive considerable attention.' . . . 'The schools do not impart what would be called, in the narrow sense of the term, technical education.' The boy on leaving school 'has a firm grasp of the grammar of the two foreign languages, and can, within natural limits, fluently write and converse in both of them. He is familiar with geography, and with the conditions of life in different parts of the world. He is well grounded in advanced arithmetic. He has facility in composition. He has been trained in accurate habits of observation. . . . When he comes to London or Paris he can fully understand what is said to him.' . . . 'The schools may not be best fitted to prepare lads for those occupations which are concerned with the making of things, but they are excellently well designed to prepare them for occupations which are concerned with

selling things.' It is interesting to know that 'great stress is laid upon the necessity of having German teachers to teach foreign tongues in these schools. It is held that only a German teacher can fully enter into the difficulties naturally encountered by a German boy.' 'The boys do practically no work in the laboratory,' and one of the teachers thought that 'we (English) were overdoing practical work in the laboratory.' The school fee is only £4 per annum. Space forbids further quotation, although we had marked at least a dozen other passages as noteworthy. And now we must turn for a few moments to the Oberrealschule. One of renown, viz., that of Charlottenburg, a suburb of Berlin, was thoroughly studied by Mr. Sadler. Comparing these schools with those of our own country, the Director says truly that 'each system has its own drawbacks and its advantages.' The rigidity of Prussia prevents the interfering parent from the accomplishment of his purpose, and keeps the weak teacher straight. The freedom of the English system enable a genius like Thring to work out his methods without the constant failing from the restraint of rigid codes. But the advantage is in our opinion entirely with us in this respect. The following is the school plan or curriculum of the Prussian Oberrealschule :—

Subject.	Number of the Class.									Total Number of Hours Weekly in the School exclusive of Home Lessons.
	VI.	V.	IV.	III. B.	III. A.	II. B.	II. A.	I. B.	I. A.	
Religion	3	2	2	2	2	2	2	2	2	19
Mother-tongue, including narration of national events	4 / 5	3 / 4	4	3	3	3	4	4	4	34
French	6	6	6	6	6	5	4	4	4	47
English	—	—	—	5	4	4	4	4	4	25
History and Geography.	2	2	2 / 2	2 / 2	2 / 2	2 / 1	3	3	3	28
Arithmetic and Mathematics.	5	5	6	6	5	5	5	5	5	47
Natural History.	2	2	2	2	2	2	—	—	—	12
Physics	—	—	—	—	2	2	3	3	3	13
Chemistry and Mineralogy.	—	—	—	—	—	2	3	3	3	11
Writing	2	2	2	—	—	—	—	—	—	6
Freehand Drawing.	—	2	2	2	2	2	2	2	2	16
	25	25	28	30	30	30	30	30	30	258

To the Oberrealschule there is often a preparatory school, concerning which Mr. Sadler remarks: 'This is one of the problems in public education alike in Germany and in England. The Head Master of an Organised Science School with us likes, as a rule, to have the supervision of the work of the boys, who are preparing for the organised science department of the school, for some two years before they actually enter it.' In the Oberrealschule laboratory accommodation is much more limited than in higher secondary schools with us. Drawing is not so good as with us. Cricket has not caught on. Although the master bought the bats and wickets, 'the boys failed to make successful use of them.' The aim of these schools is tritely given. 'He (the master) wishes to prepare the lad, who will afterwards proceed to technical studies, by a liberal education based on lines not foreign to his normal experience and future occupation.'

As to the **Code**, we can only say that it will repay perusal, great care having been taken in drawing it up.

ART. 16.—**Continuation Schools in Saxony.**—The origin (from Sunday Schools) and development of these schools is well shown by Mr. Dale. The one element striking an Englishman is the compulsion which is real and effective; masters, parents, and the youths themselves being under penalties compelling regular and punctual attendance. '*Business at home or trade employment of any kind is never to be accepted as an urgent ground*' for absence. The justification of this compulsion is contained in the following words: 'If the great majority of them (*i.e.* boys of fourteen and thereabouts) be left alone, they will never again open a book, write a composition, or work a small sum, that is not forced upon them.'

Furthermore, a movement is on foot to get the masters to allow one afternoon per week to their young workmen, who may thereby greatly enhance the value of their continuation schooling. At Leipzig the employers, the teachers, and the pupils meet together at the beginning of each half year's work, and as a result the interest of the employers is obtained. There is much room for this kind of work with us. We strongly recommend this report to the notice of every teacher and manager connected with a continuation school, since it is eminently suggestive. With respect to the intellectual, the moral, the physical, and the industrial education of young men and maidens 'moral education has always been one of the chief aims of the Fortbildungsschule' (Continuation School). Mr. Dale concludes with a small bibliography of his subject, which is greatly to be commended.

ART. 17.—**The School Journey in Germany.**—Readers of the PRACTICAL TEACHER are well acquainted with the writer of the report on this subject, for Miss Dodd has, on more than one occasion, interested them with her accounts, whether of German schools or of their methods. In particular, Miss Dodd's Herbartian lessons will be remembered. What Miss Dodd does, she does thoroughly, so that before writing of the German School Journey, she must perforce go through it as a personal experience. The description, therefore, of the two journeys, viz., one from Blankenhain for three days in the Thüringian Forest, the other from Jena for a six days' jaunt from Jena to the Rhöngebirge of Bavaria, has the vividity which is born alone of personal experience. As to the wisdom of these journeys there can be no doubt, and we join with Miss Dodd in hoping that an extension of this branch of German school practice to England may be a matter of early accomplishment. Prejudice would be the main obstacle to overcome, and Miss Dodd's article is one of the very best arguments that can be brought against those who would forbid school journeys on account of their novelty or impracticability. We shall give, at an early date, Miss Dodd's account of one of these journeys, expressly written for the PRACTICAL TEACHER, when our readers will learn from the Special Reports that 'The Englishwoman carries tea, and very soon enough of this beverage was brewed to serve the whole party,' and how, when 'one boy cried with cold, and, as he had no wrap, an Englishman of the party gave him his overcoat.' It will be interesting to note that the cost of this latter journey worked out at 15s. per head per boy, which included railway fares, lodgings, food, and all expenses of the six days' journey. Of the preparation that preceded the journeys, to the end that they might be thoroughly appreciated, and of the many lessons in composition, geography, and history that were based upon the journeys, we say nothing, except that as an educational instrument the school journey ranks second to no one with which we have acquaintance, and Miss Dodd is to be congratulated upon having introduced the journey so pleasantly and so forcibly to her English fellow teachers.

ART. 18.—**The Teaching of the Mother-Tongue in Germany.**—Under this head we have an account of the early training of the youngest children in acquiring the sounds of their tongue in the Normal Word System, which owes its origin to the great French educationist Jacotot. It appears to be a combination of the phonic system, and the look-and-say, pictures being used to emphasise the interest, the work being purely oral. German being mainly a phonetic language, this procedure is much easier to follow in Germany than in England. 'Let the teacher speak little, the children much' is the guide to conduct here as elsewhere, and there is little difference between England and Germany at this early stage. 'The hours devoted especially to German vary from eight per week in the lower classes to six in the upper. The subject can be best grouped as usual under the three heads of reading, grammar, and composition (including orthography).' . . . In no time-table will these three be found in isolation, or each allotted to a special hour. The subject is simply styled '**German.**' In the first place, therefore, it lies entirely in the discretion of the teacher to decide what portion of any given hour shall be devoted to any one of these branches. Such freedom brings in its train undoubted advantages. For the rest, it may be said that the German teacher proceeds with laborious thoroughness piling detail upon detail in a way that leaves little for the child to imagine, say, in the case of a piece of poetry, whereas in the case of children of ordinary intelligence, so long as no obscure words are used, it is preferable that they should do for themselves the needful building up, and not that the teacher should, by a long-winded process of composition, take the very essence out of the passage under study. Exposition and analysis are undoubtedly overdone in this connection by the Germans, as indeed the writer of the article admits. Sentence answering, and the correction of one part of the class by another, are good, but they are English as well as German practices. In fact, the lesson from this report is in the paragraph which refuses to separate grammar from language, and it is in this respect that English practice must reform. Grammar from language is the rule in Germany. 'A path to a

better method lies open only when we have broken once and for all with *the dangerous principle that the grammar of one's native language should be learnt like that of a foreign one.*' There is much wisdom in these italicised words. 'No teacher should be entrusted with the instruction in the mother-tongue, who is not capable of treating it from a historical point of view.' What would an English teacher say to this undoubted truth? Here, again, we must reluctantly conclude by referring our readers to the report itself, the perusal of which will be profitable as well as interesting.

ART. 19.—**Holiday Language Courses in France and Germany.**—In our holiday number we dealt with this subject somewhat exhaustively; we must, therefore, content ourselves with an expression of approval both of the practice and of the article that describes and recommends it.

ART. 20.—**Recent Educational Progress in Denmark.**—Mr. J. S. Thornton, himself a secondary teacher, has spent much time in the study of the Danish system of schools, for which system he has almost an enthusiastic appreciation. The special feature of the Danish system consists in the recognition of private adventure schools that come up to a certain standard, the test for which is ability to prepare for the leaving certificate. The schools thus get the countenance and support of the State accompanied by very little interference, the result being a cheap system of secondary education, for the efficiency of which the State has at least some guarantee. This is an undoubted gain likely to do harm to nobody except the incapable would-be teacher who can flourish in England, but who would very promptly be snuffed out were Danish conditions to hold in this country.

Incidentally we get glimpses, pleasant and the reverse, of the primary school. Here are a few instances. 'The curious part of the relation of the State to the elementary schools is that **it claims in return for its ever increasing grants no general right to inspect the instruction given in the schools.** The inspection is for the most part of a local and non-expert character. 'In every parish there is a **School Commission,** consisting of three persons, **of whom the clergyman is chairman,** *ex officio*, the other two being elected by the Parish Council. It is the duty of this body to act as inspectors of the parish schools.

Then comes the **School Directors** who appoint the teachers from a list supplied by the Parish Council. The supreme authority is the Education Office.

Here is the way in which a Head Master's salary is made up in Jutland:—'160 bushels of barley, or rather the money value of it; 290 kroner from the commune in lieu of the land formerly belonging to the school; 100 kroner from the commune in lieu of school pence (1 krone for each child); 20 kroner as precentor; 270 kroner from Christmas, Easter, and Whitsun offerings, which the schoolmaster gets at the same time as the clergyman; 50 kroner on account of length of service from the school fund of the Amt or county; 265 kroner from the State, an augmentation given to poor schools only; six cords of firewood for his own private use; and a residence assessed at 150 kroner.'

In country schools only half the children attend at one time, so that rural Denmark is the home of universal half-time. A comparison between such a school and a Surrey rural school gives Mr. Thornton the occasion to remark that 'the body (in Denmark) is less fair, but is animated by a freer and more active spirit,' which if intended to censure the poor staff of English rural schools—those of Jutland having three class-rooms, each with its adult teacher—we endorse; if contrariwise it represents Mr. Thornton's opinion of the rural teacher (other than the Art. 68), it only shows how little Mr. Thornton knows of this part of his subject.

Then come the Kold schools, which will have nothing of State inspection. '**But though few head teachers in these schools get more than £35 a year, the State will offer them grants in vain on condition of subjecting the children to any set examination.**' We wish we could follow Mr. Thornton further in his remarks as to the training of teachers, and as to the various types of classical and Real schools, and as to the efforts of Bishop Grundvig, who got his inspiration from England, and of his great follower Kristen Kold, of the history of Danish dairy schools and how their butter is 'mixed with brains,' and smacks of the schools; but alas! the tit-bits so carefully marked for quotation must like the innocents be massacred. One quotation, however, we must make since it neatly puts the lesson from the Danish principle of help without interference, and will, in addition, commend itself to every practical teacher: '**It seems incontestable that, given men with their hearts in their work, like these Danish high school teachers, the State profits from its grants to them in inverse ratio to the amount of interference in their work.**' The application of this voluntary spirit is best seen in the Capital, where there is but one single State secondary school, all the rest being private schools recognised by the State as efficient. Mr. Thornton's concluding words must be borne in mind whilst reading his report: 'I hope I may induce some of my countrymen to visit Denmark for themselves. **The private teachers will find there an organisation of secondary education which they need not fear;** and the statesman will find in individual enthusiastic effort, helped and guided (but not too much helped and guided) by the State, a force of unsuspected power and economy, which is as ready to operate in England as in Denmark, when once the fitting conditions are introduced.'

ART. 21.—**Education in Egypt.**—Upon this topic Inspector and Ex-Principal Barnett writes with knowledge and clearness. His interest in this question probably dates from the time when, as Principal of the Borough Road Training College, he had several Egyptian students under his charge. Of the Kattubs, or lowest schools, the master of which 'may be and often is blind,' of the primary schools which come next, and of the first grade primary schools yet a step higher in rank, Mr. Barnett has little of good to say, except that things are taking a turn for the better, thanks to Mr. Douglas Dunlop and Yacoub Artin Pasha. Interesting as Mr. Barnett's paper is, we cannot pretend that it has much of guidance for the practical teacher here, and so with these few words we may consistently dismiss it.

ART. 22.—**Education of Girls in Spain.**—Senor don Fernando de Arteago y Pereira, Taylorian Teacher of Spanish at Oxford, tells all that can be told of the progress of female education in his native Spain, the burden of his tale being the doleful one of little accomplishment. But here again there is a gleam of hope that in the near future the beautiful señoritas of Iberia may become at least sufficiently enlightened to read and write.

ART. 23.—**The National Bureau of Education in the United States.**—Mr. Sadler should certainly take keen interest in the doings of the Bureau, for its objects are very similar to those aimed at by Mr. Sadler's own department. His description of the Bureau is as follows:—'It occupies a four-storey building with about six rooms on each floor. In the basement are stored the documents published and distributed by the Bureau. There is also a laboratory for the chemical analysis of air and gases in school buildings and similar investigations. On the first and second floors are accommodated the large clerical staff, the statistical compilers of the Commissioner. The third contains the library, and the fourth the educational museum.' . . . The correspondence of the office deals with almost all the countries of the world as well as every part of the United States. Communications are maintained with schools, school authorities, private educationists, and every department of educational activity. The following are some of the numerous special subjects that are dealt with from time to time: the various compulsory school laws; facts and arguments bearing on the coeducation of the sexes in schools and in colleges; instruction for deaf mutes; organisation and management of technical schools; the early history of public instruction at home and abroad; the state of primary education in foreign countries, and also of secondary education; methods of military education in Europe; needlework teaching in Germany and in Holland; agricultural instruction in Europe, etc., etc. The publication side of the Bureau is its most important side. 'Contributions are solicited from educationists at home and abroad.' In his Appendix Mr. Sadler shows how far reaching is this admirable Bureau, which is the only official instrument whereby the various systems of education obtaining in the several states may be influenced as a whole, as influenced they undoubtedly are, and for good.

ART. 24.—**The Manitoba School System.**—The sub-Director furnishes in this report another object-lesson on the influence of contending sectarianism upon the schools. Very clearly he shows how education in Manitoba was at first voluntary and sectarian, how when Manitoba became an integral part of the Dominion, Protestant and Catholic schools existed side by side, the former not being bound to support the schools of the latter, and *vice versâ*; how also the Protestants increased and multiplied and became a preponderating majority; how the Manitobans cried out for a common school system that should know no sect; how they obtained this, and how upon appeal this was declared unjust, and how finally Mr. Laurier, himself a Catholic, settled the dispute—at least temporarily—on the following lines:—'On a petition signed by the parents or guardians of 10 children attending a school in a rural district, or of 25 children in a town or village, any clergyman or authorised religious teacher is to be permitted access to the school to give religious instruction at stated times. And in any town school where the average is 40 or upwards (in rural districts 25 or upwards) they may be entitled to the service of one Catholic teacher, who must, however, be fully qualified according to provincial or national school standards. In districts where the people speak French wholly, they are to have a teacher speaking both French and English, so that the teaching may be on the bi-lingual system. But schools are to be national, under provincial control, and all subject to the same regulations and inspections. The same text

books are to be used, and all teachers must be properly qualified by passing the provincial examinations and taking the prescribed normal school course.' To this plain statement of the compromise little need be added, except that it appears probable that the objections to it may at last die out, and the settlement become one in reality.

ART. 25.—**The Admission of Women to Universities.**—Messrs. Sadler and Longsdon herein summarise for us the particulars concerning the progress of University education amongst women in all parts of the known world, for which all sympathisers with the good cause of the higher education of women will be grateful, the gratitude becoming more pronounced as the perfection of the report is more and more appreciated.

ART. 26 is a **list of official publications upon education** in all its branches, full particulars as to price being given. This will also be exceedingly useful, and again Mr. Sadler must be thanked for supplying a real want.

And now that we have skimmed over the surface of this epoch-marking Special Report, we become more and more conscious of its excellence and of the wisdom displayed by Mr. Director Sadler in choosing his matter and his men. We apprehend that whenever educational topics come next on the *tapis*, whether in the House or outside, Mr. Sadler's volume will be specially helpful in the provision of the multifarious facts, figures, and arguments that are needed to illustrate and elucidate the varying phases of modern popular education. We heartily congratulate Mr. Sadler upon the production of such a goodly monument of pedagogy and pedagogics.

SOME HUMOURS OF AN INTERNATIONAL 'FERIENKURS.'

BY MISS C. I. DODD,

Author of 'The School Journey in Germany' in Education Department's Special Reports on Educational Subjects 1896–1897.

A GERMAN 'Ferienkurs' is a holiday meeting designed for the purpose of providing foreigners with opportunities of hearing lectures in the German tongue and of studying the language. Teachers form the majority of those who haunt these holiday meetings, therefore an ideal course, which considers 'the greatest good of the greatest number,' lays itself out to meet the needs of the teacher. The time is the first consideration. The scant leisure of the teacher comes in the months of July and August, therefore these months are favourable for holiday courses. The place is a weightier matter. The ideal locality would be a small university town, far away from the rush of the great world. This town should possess ancient memories, literary associations, and a certain philosophical flavour, which is distinctly German. If the streets of our ideal town are cobbled and crooked, if the houses are red-roofed and quaintly gabled, if the fountains are eccentric, the drainage primitive, and if the traditions date back into the fifteenth century, if a halo of glory lights upon the whole place by virtue of the great names of the men who have lived and worked here, and further, if no cabs or tramcars disturb the peaceful streets, and no electric light flashes its vulgar glare into the sanctity of the quiet night, so much the better for the holiday course and the teacher. The surroundings also require attention. Our ideal town should lie in a valley upon a winding river, around it should rise hills clothed with masses of dark pines, and miles of beech woods. The upland meadows on the lower slopes of the mills should provide fragrant stretches of clover, vetch, scented bean fields, stately maize and ripening grain. The white roads through the valley and up to the heights should be fringed with plum and cherry trees, and tiny, drowsy, peaceful villages should dot the surrounding landscape. The cynical reader shrugs his shoulders and intimates that our demands are too severe, he begs us to moderate our aspirations, and asks where on this weary earth in this busy matter-of-fact age of ours, can such a spot be found. Our place is no Utopian vision. If the cynical reader will journey to the Thüringen forest and take up his abode for a season in the little university town of Jena, he will find all the conditions of an ideal place for a holiday course fulfilled, he may even discover fresh delights for himself, if his cynicism will permit him, for one's sense of the beautiful is limited, and it requires half a dozen various intelligences to do justice to a single touch of nature. Having fixed our time and place, the people next demand our attention. They are a motley gathering, and they are well worthy of our attention. Pope tells us that 'the proper study of mankind is man,' and if one wants to study his kind from an international standpoint, he will find ample opportunities to do so in a German Ferienkurs. So many incidents and personalities flit before my vision that it is difficult to select the most striking, but the Germans themselves claim the first place. The simplicity and cordiality of German home-life is charming; one soon enters with zest into all the festivities and excursions which are provided for the stranger. The German Frau is the first personality to be considered. She is a kindly, cheerful, lovable soul. She encourages one's timid attempts at speaking the language, and is indulgently patient with all our errors. She finds out that English people eat eggs, porridge, and marmalade at breakfast, and she provides these dainties accordingly. She takes the poor, halting, stammering foreigner at once under her protection, and all goes well with him. Next to the Frau the philosopher is the most characteristic feature of German life. Philosophers are everywhere; the German atmosphere seems favourable to their growth. Every other man one meets in a university town is either preparing his doctor-arbeit or 'has made his doctor in philosophy.' The table conversations are lively and earnest contests between the men on the deeper problems of life and death, and the women are expected to listen or talk to each other about the making of sauces. Almost all German men appear to be Jupiters and all German women are Marthas. This seems to answer very well, and it may be an ideal state of things. The German man astonishes one with his learning and his profundity of thought. He has usually written a work consisting of several volumes on some abstruse point. To the average mind it appears a matter of unimportance whether this point be settled or not, but to the German it is a matter of life and death. The German philosopher refuses to take Woman seriously, he thinks that her attendance at lectures is due to unholy aspirations for which the 'Woman Movement' is somehow accountable. He naively supposes that the Englishwoman is 'emancipated' when she signifies her intention of attending his lectures, and when she asks him what that means, he looks puzzled. His tone towards women is one of jocular indulgence, such as we assume towards spoiled children. The recreation during the holiday course usually consists of gatherings in the evenings in an inn or garden where beer is drunk, speeches are made, and songs are sung, while occasionally these gatherings end with a dance. The Ausfluge is also a popular evening entertainment; this is a walk to some tower or castle on one of the hills. The professors conduct the party through the pine woods to the chosen spot, and then beer is drunk and a simple evening meal of eggs or sausage and bread is partaken of in the open air outside a primitive inn. When the sun sets the party provide themselves with lighted torches and wind their way down, through the dark pines to the town. There is a simplicity and friendliness about all these proceedings which are very favourable to friendship and frivolity. One soon learns one's neighbours in these Ausflüge. The gigantic Norwegian who trod on the English girl's umbrella and smashed it, yet who danced so nimbly with the lively Danish girl in the plaid blouse soon became a familiar figure. He distinguished himself by singing at the evening gatherings. His favourite song was 'Ein lustiger Musikante' with the chorus 'O tempora O Mores' in which we so often joined. One Hungarian of an excitable nature contrived to make a great deal of noise. He was a lean, sallow man, with roving eyes and a rapid impatient manner. The Englishwomen avoided him because his manners were very free and because he had a habit of spitting on the floor in the lecture-room. He had a discussion one day with an Englishwoman over the merits of Byron as a poet, and when she refused to rank Byron with Homer and Shakespeare, he danced with rage and told her that the English were a 'proud, cold, stiff, orthodox, conventional nation.' The Englishwomen avoided him more after this dispute. At the

end of the course he called on one of the Englishwomen to borrow a book, and she offered him tea. He made exaggeratedly polite remarks, but finally declined the tea because there was no rum to put in it. Then he took the Englishwoman into his confidence and discussed his matrimonial prospects with her. There is a childlike inconsequence about the Hungarians which renders them very engaging. There were three Hungarian brothers whose ages varied from 16 to 20; they were lithe, active, brown-faced boys, and they took an astonishing interest in England and English politics. The eldest brother warmly defended Mr. Chamberlain and all his actions, in an argument with me, and he grew crimson with warmth when I ventured to disagree with some of his conclusions. The Swedes were a little wearisome. There was one ponderous dark man whom we called the 'black Swede' because we could not remember his name. He was too instructive. He used to ask me many questions about England concerning the payment of members of parliament, the population of London, the building of warships, the author of 'Lucy Gray' and so on, and then contradict all my statements and proceed to give me information about my own country. There was also a lively Swedish lady, who told me she longed to come to England to see the peach gardens; she seemed to think England was one vast peach orchard. She told me she translated English novels into Swedish, and she mentioned novels I had never heard of, and assured me that they were written by our greatest English novelist. There was an eager, swarthy, little Servian who had come to Germany to study the educational system. His eyes glowed when he talked of teaching, and one instinctively thought of Pestalozzi. There was a stately Armenian who was studying the ways of Holiday gatherings in order to report on them to his Government. He confided to me the chief criticisms he meant to pass on the movement in his report. There was a tall, dark eyed American, with an eccentric taste in ties; we called him the 'barbarian,' because he loved bright colours and revelled in singing the German songs with the rousing choruses. He made friends with two French boys with whom he took long walks. The trio joined hands and sang as they danced along the country roads to the amazement of the peasants working in the fields. He had just come from Harvard University covered with glory. His animal spirits and his boyishness were a delight to me. I hope Harvard has a goodly crop of his kind. He is the American youth whom Walt Whitman sings of in his wild, stirring strains. Altogether there were about 140 members of the meeting. We were of all ages and nations, but we soon settled down to the routine of the course. We attended lectures in the morning, and the serious and studious members were sometimes found at afternoon lectures. The conversation class was perhaps the most amusing. Here were people of all nationalities collected together for the purpose of talking German. We soon became friendly and laughed at each other's mistakes. The Irishman who was called upon to relate the Story of Schiller's Marriage in Jena, declared he himself had married Charlotte. He knew hardly any German, and the word 'married' was unknown to him. Then there was an Englishman who declared that he lived above the heavens; he merely substituted above for under. We naturally called him 'a god' after this mistake. A number of pleasant tea-parties were instituted chiefly by the Englishwomen, and we met together in each other's balconies or gardens to drink tea, improve acquaintances, and sometimes to sing songs. There was an Italian musician who came to some of these parties and played the violin for us and sang German and Italian songs. The Englishwomen this year were numerous. Manchester, London, Cambridge, Oxford, Liverpool, Cheltenham and Birmingham were all well represented. One Englishwoman originated the idea of giving an English garden party in the Schiller garden. This was a bold venture, and required skilful diplomacy to carry it through. The Schiller garden surrounds the house where Schiller lived when he was a professor in Jena. A bust of Schiller stands there, near which is a hugh block of stone bearing the inscription that upon this Schiller wrote his 'Wallenstein.' An old stone table and seat stand under the trees near the river Leutra, which flows around part of the garden, and an inscription testifies that Goethe and Schiller often sat at this table exchanging great and good words with each other. The Englishwomen formed a small committee, and they were advised to ask a certain professor of astronomy, who lived in the garden, for permission to use the garden for a party. He was courteous, but declared that it did not lie in his power to grant it. The Englishwomen next approached the Curator of the University, who referred them to another authority, who asked permission of yet a higher power.

BUST OF SCHILLER IN THE SCHILLERGARTEN.

Rumour said that the matter was finally referred to the Reichstag in Berlin and sanctioned by the Kaiser; but, however that may be, the permission was granted, and the Englishwomen determined to make the party a success. Pessimists shook their heads and declared that no party in Germany would be appreciated unless a few casks of beer were introduced, but the Englishwomen did not heed these scoffers. Daily, after the lectures, the indefatigable committee met by a window in the Corridor and discussed practical questions. They scoured the town for plates, spoons, tables, chairs, cups, flowers and cakes. The Englishmen nobly came to their aid and provided a German band. Invitations were issued to all members of the course, the professors and their wives, and a few private German friends. On the morning of the party an Englishwoman and one or two Englishmen appeared to sweep the garden and make all spick and span. An Englishman carefully brushed the bust of Schiller, and an Englishwoman dusted him with a soft cloth to make him respectable for the occasion. The gathering was a great success. The sun shone, half a dozen English girls made the tea and coffee, an amiable Pole with a bicycle and a quick-witted German boy were on the spot to remedy all defects. When butter ran short, the Pole on his bicycle was off like lightning to procure more, and when the grapes were finished the German boy ran off to get a fresh supply of these dainties. The band played, the company assembled and drank tea, and all went happily and well. Before the party dispersed they danced a German polonaise on the grass, and Schiller looked benignly down upon the festive scene. One pleasant feature of our party was the Frau's birthday. The German philosophers who resided permanently in our boarding-house arranged the festivities. Birthdays are charmingly celebrated in Germany, and philosophers appear to be particularly skilful in arranging details. Early in the morning we went into the saloon and found the presents arranged upon the table surrounded by piles of beautiful roses. We stood on the balcony and watched a band of twenty musicians stealthily assemble under the trees by the University library. Then they came nearer, placed themselves under the Frau's window, and played glad strains to usher in her birthday morn. The Frau joined us, and we cut the birthday cake and partook of breakfast, while the music continued to play below.

In the evening we had a party. After supper we all made German speeches in honour of our Frau. An Englishwoman, whose vocabulary was large, but whose grammar was lamentably defective, made the opening speech, which was received

with shouts of corrections. The foreigners naturally made many errors in their speeches, but the Germans were indulgent and gave them credit for the sentiments they wished to express. A Japanese poet made a speech in his own tongue, which nobody understood and everybody warmly applauded: he translated his remarks into German afterwards. They were flowery and graceful enough even for a Japanese poet. The philosophers were eloquent; they interwove the Frau's

'OUR FRAU'S BIRTHDAY.'

virtues into their own particular systems of philosophy until one was haunted with the idea that the German woman was somehow subtly associated with German philosophies. The Russian doctor said that Goethe had hit upon this association when he said 'Das Ewig-Weibliche zieht uns hinan.' The only foreigner who spoke absolutely without errors was an English girl who had only been studying the language for a fortnight. Her speech was short: she said, 'Frau —— wohnt in Jena. Jena liegt an der Saale." Her speech was received with the applause it merited. The Frau replied gracefully to all these greetings, toasts were drunk, songs were sung, and finally we danced German and English dances. The Japanese poet regarded the dancing with disapprobation. He thought it trivial child's play, and he considered it immoral for women and men to dance together. We made many pleasant acquaintances before the course was over, some of us learned much German, and perhaps some of us learned to look at some things from a German point of view. One girl told me that she came to 'get German thought'; she said 'German thought was educating.' I asked her after a month's study if she had attained her object. She shook her head and said German thought embraced too much for a holiday course to cover. She went to Berlin to study for the winter. A holiday course cannot give one universal culture, but it can, and it does, stimulate individuals to look at things from another standpoint, and so broadens one's outlook. A German holiday course also improves one's speaking acquaintance with the language of the country. The chief good, however, appears to me to be the international element. We were associated with people of many nations, and a common interest for the time being, bound us into a community. Some of the partings were sad, but we have pleasant memories, and those of us who meet again will have some interests to revive and many memories to recall together.

CHILD STUDY AT THE OXFORD SUMMER MEETING.

ON Thursday, 19th August, an interesting meeting was held under the presidency of Mr. Marriott in the Examination Schools, where the annual gathering of University Extension students and others had its headquarters for three weeks.

An unusually large number of foreigners—many of them teachers—attended the courses of lectures given, and advantage of this was taken to hold what was dignified by the name of an International Educational Congress.

The main object of the meeting was to hear from the foreigners what their practice was with regard to the following departments of education: 'Training of Teachers,' 'Correlation of Primary and Secondary Education,' 'Inspection of Schools,' 'University Extension,' 'Teaching of Modern Languages,' and 'Child Study.'

Dr. Schmidt, Saxony, gave a very clear account of the system of training teachers in his own country; French education was well expounded by Madame Landolphe and Mons. Garnier, who described the Secondary School system of France; Miss Vorkhammer spoke for Denmark, and Mr. Grieg for Norway.

It should be specially noted that every one of the speakers addressed the meeting in English, and the chairman remarked that the vexed question of how to teach our children modern languages seemed in a fair way to solve itself in a very easy way for us, as all the other nations were determined to learn English.

At the close of the meeting the Secretary of the 'British Child Study Association'—Miss M. A. Clapperton—was asked to address the audience.

She said there were two lines of work in the observation of children.—(I.) General observations might be made on one or on a few children by parents, nurses, private tutors, and governesses, and by students undergoing training. Well-known examples of this kind of observation were Preyer's 'Die Seele des Kindes,' Sully's 'Studies of Childhood,' Miss Shinn's 'Notes on the Development of a Child.' (II.) Special observations of one or a few points might be made on a large number of children by school teachers and inspectors. The investigations made in Germany and in America into the contents of children's minds on entering school were a good example of this.

Dealing with some objections to such observation, the Secretary said they were often told that it was impossible to observe the child without making him self-conscious, and so defeating the end in view. This objection, if it were real, would be fatal to observation, but it is to a great extent imaginary; with proper precautions a sympathetic and tactful observer can find or make opportunities of observing children without making them conscious that they are being observed. Again, it is objected that observations made by the ordinary layman who has had no special scientific training have no scientific value. The reply to this is that though true of certain classes of facts, it is not true of a very considerable proportion of the phenomena of child life. It seems to have been already demonstrated by the returns made out by Dr. Stanley Hall that there are plenty of observations which can safely be made by the intelligent teacher. As a recent writer on the subject says, 'Some psychological facts are almost as concrete as fossils, which are the same whether picked up by a man of science or a peasant.' Further, even if the facts, when observed by one who is not a scientist, are valueless to psychological science, no one will doubt that they are of immense value to the educator as a means of quickening his sympathy with his pupils; and if special training is necessary it can and will be given just as soon as teachers seriously demand it. The laboratory for Experimental Psychology about to be opened in University College, London, under the direction of Prof. Sully, will soon provide training of this kind, of which, it is hoped, teachers will avail themselves.

The meeting, at which over 200 persons were present, was considered one of the most successful functions of the Summer School.

EDUCATION IN THE AUSTRALASIAN COLONIES.

I.

THE systems of education prevailing in the various Colonies differ somewhat from each other in details, but in essentials they are practically alike. In all the Colonies, with the one exception of New Zealand, the actual administration lies in the hands of the Minister of Education and his Department. It is the duty of the Education Department to purchase land whereon to erect schools, and not only to build the schools, but to keep them in repair. The Department also establishes and supports training colleges for teachers, and the appointment or dismissal of teachers lies solely within the power of the Department.

To aid the Minister and his Department in carrying out the system in its various details, there have been appointed in all school districts certain local authorities. In New South Wales they are known as 'Public School Boards,' in other Colonies they are termed 'Boards of Advice.' The latter name is perhaps more significant of their powers and duties than the former. Their duties are of a well-defined and restricted character, and are laid down for them in tabulated form. As the powers allowed the Boards in all the Colonies are practically alike, I shall jot down here the main lines on which their duties run—

1. They have power to allow the *occasional* use of the school for other than school purposes; but should any application be made for the *regular* use of the building after school hours, they can only send such application to the Minister, coupled with their recommendation should they be favourable to it.
2. They have to report on the condition of the school premises; whether a new school may be required, and as to what appliances of any kind may be needed.
3. It is their duty to visit the school from time to time, observe the management of it, and record the number of children present.
4. It falls to their lot also to do their utmost to induce parents to send their children regularly to school.
5. Should any child show unusual ability, they can recommend the Education Department to grant said child a scholarship or exhibition for further education.

These are practically the limits of 'Board' authority in the Colonies. There is one other matter, however, that may be mentioned. In the appointment or dismissal of teachers I said they have no part; should a teacher, however, be guilty of persistent carelessness, it becomes the duty of the Board to report the matter for investigation, and if the fault be a gross one, they have power to suspend the teacher till such time as the Department arranges to have the matter enquired into. This central control seems to render quite impossible any dismissals on the grounds of local feeling. The arbitrary discharging of teachers, which some few months ago caused such a cry in our midst, is never heard of in Australia. Their tenure of office is of the surest kind. Should the enquiry by the Department show that the teacher has really been seriously culpable, he may be severely censured, or removed to a smaller school with a warning.

The foregoing remarks apply to all the Australasian Colonies with the exception of New Zealand. In this Colony, unlike the others, the administration of educational affairs is placed in the hands of local managers. To put it shortly, the entire Colony is divided into twelve 'educational districts,' each under a Board; but each educational district is again subdivided into 'school districts.' The ratepayers in these school districts elect a 'school committee' every January, consisting of seven resident householders. These several school committees then proceed to elect an Education Board consisting of nine members, one-third of whom retire each year.

The powers of this Board are of course very extensive. Its duties are almost similar to those of the Education Department of the other Colonies. It establishes and maintains public schools, creates school districts, appoints and removes teachers and other educational officers. It establishes scholarships, school libraries, training colleges, and high schools. It also, of course, administers the funds by which the educational system is mainly supported.

These funds consist of—

1. Grants from the public revenue. The Colonial Treasurer grants to each Board £4 for each child in average attendance. There is a further capitation grant of 1s. 6d. for scholarships, should such a sum be required. The Boards also receive building grants for new schools. In the four districts where normal schools are established, a further grant is given for their maintenance.
2. All rents or profits derived from property vested in the Board.
3. Special grants for particular purposes.
4. Special fees for higher education. (The ordinary elementary education is free.)
5. Donations and subscriptions.

Although the school committes are quite subordinate to the Education Boards, their powers are still considerable. They can establish schools, 'with the express sanction previously obtained of the Board'; can erect, enlarge, and improve school buildings, and can provide school apparatus. They have power also to appoint teachers of sewing. From this it will be seen their authority is more extended than the corresponding bodies in the Australian Colonies.

The principle of the New Zealand system is, I think, worth noting. A committee with real but limited powers over the schools in its own district is elected by the ratepayers; a Board having much larger powers, and entrusted with the supervision and control of the school committees, is elected by the committees. Many of the evils arising from small School Boards in some parts of England and Scotland might be obviated by the adoption of such a system as this.

Both systems mentioned seem to work very smoothly. There *may* be occasional friction between Education Boards and school committees in New Zealand; between the Boards of Advice and the Department there can scarcely arise any serious difference, the powers and privileges of the former being so restricted. As a rule, the school committees and Boards of Advice consider that, although they possess no real authority over the schools, their position enables them in all instances to strengthen the hands of the teacher very considerably. In some country districts, where suitable men to fill a position on a Board of Advice are often scarce, teachers may not see the members from one year's end to the other. In a few instances I have heard teachers urge a complaint that members seem only too willing to exercise their authority as far as investigating the teacher's conduct is concerned. As the ultimate result of such an enquiry is not affected by their views of the case, even here they can hardly do more than annoy.

In a country like Australia, where there is such a diversity of local conditions, one class of school would not meet the requirements of every class of district. There are immense districts where the population is so scattered that it is impossible to secure regular attendance at school, or even to build schools which would be accessible to all the children. Such is the condition of things in the outlying parts of the various colonies that floods may cut off the schools for days together from the children in their immediate neighbourhood.

There are two kinds of schools, viz., Provisional and Public. A *Provisional* school may be established wherever an attendance of a dozen pupils can be guaranteed. Should the people of the neighbourhood be desirous of having a school in their midst, they must communicate with the Minister, who usually sends the school inspector of that district to enquire into the matter. One essential is that there are no means of education within four miles by the nearest route 'practicable for children.'

In districts where not even a dozen children can be guaranteed, but where there are still a number who wish to be educated, the regulations provide that 'wherever twenty children, between the ages of six and fourteen, are residing within an estimated radius of ten miles from a central point,

and can be collected in groups of not less than ten children in each,' two half-time schools shall be established, and one teacher is to divide his time equally between them. The usual custom is to give the forenoon to one school, and the afternoon to the other, but should he think that other arrangements than these would better suit the case, he usually can make the necessary alterations with the sanction of the district inspector. In a school of this kind, the teacher is allowed 'a sufficient annual allowance for horse forage, irrespective of the salary attached to the schools,' and in every case he takes the rank and salary obtaining in the public schools of the same average attendance. These salaries and other matters I shall deal with later on.

It will show, I think, something of the fine vigour that has been displayed in constructing and maintaining a system of effective elementary schools in these Colonies, when I mention that even the case of districts where the population is still more sparse than those instanced has been considered and provided for. In such districts an itinerant teacher is provided, who goes from house to house, and teaches at one time perhaps the children of one family or maybe the children of two or three families living within reach of each other. The teacher in this case may not always be trained and fully qualified, but he must be a 'person of good moral character and must satisfy the inspector that he is capable of imparting the rudiments of an English education.' The subjects usually taught are limited to reading, writing, dictation, and arithmetic. The work is considerably supplemented by a regular course of home lessons. In the provisional and half-time schools the curriculum is less ample than that in the ordinary public school, but the customary standard of proficiency must be attained.

I have travelled pretty widely in outlying parts of New South Wales, and I cannot recall visiting any neighbourhood, however secluded, that did not possess in one form or other a place of education. It is nothing unusual to come suddenly in sight of a neat little wooden structure, raised some foot and a half above the ground on piles, and situated in what may really seem the heart of the wild bush. The type of building informs you at once of its nature. Should you enter, the cleanliness and order of the children may strike you with surprise. This feature always, I remember, impressed itself upon me with pleasing emphasis. Despite the wild situation of the school, the teacher may probably be a lady, who boards in the home of a settler near, or who may ride to and from school on horseback. The securely fenced horse-paddock behind the school is a familiar adjunct to such a building.

In a neighbourhood of smaller population the school may take the form of a rough slab and bark hut, furnished with rude benches. The warm air blows freely through the open doorway and the glassless windows. The busy hum of children's voices is heard as you ride up, and as the sound of your horse's hoofs strikes sharply on his hearing, the teacher may pass through the doorway and salute you frankly. He may probably be a superior kind of miner who has by some accident been rendered unfit for digging. You notice, as you leave, that part of the scrub has been roughly cleared away to provide a sort of playground.

And so wherever you travel you find similar institutions, rude and imperfect, or neat and pleasing, as the case may be, but from first to last a visitor to these Colonies would be both amazed and pleased to note the healthy 'push' displayed everywhere in the spread of education.

A remarkable feature of these bush schools is the great success which evidently attends them. I have heard several inspectors remark on the pleasure they have experienced in visiting and testing the children in these uncouth places of instruction. One inspector, in a conversation on the subject, told me that in many districts he could not insist on the usual standard of proficiency being shown. His visit was looked upon as highly satisfactory if he found the teacher had been doing his or her duty in a thoroughly conscientious way. His object lay more in the way of strengthening and encouraging teachers and pupils than in making any severe test of the work done. Even in the case of half-time schools, which are not usually regarded as satisfactory in the home country, the work overtaken seems to merit commendation. Inspector Kevin remarks :—

'I have found on the whole that the half-time and house schools do the best work, particularly if supplemented by a thorough course of home lessons and exercises, as all are or ought to be. I have no difficulty, as a rule, in gauging the merit of a school once I see the work done at home. I attribute the excellence of the half-time and house schools to this, and to the regular breaks in the school work; for it appears to me the children always come up brighter and fresher after a day's rest.'

So much for schools of the 'provisional' order.

A *Public* school may be established in any locality where a regular attendance of twenty children between the ages of six and fourteen can be guaranteed. To further facilitate the attendance of children at public schools certain of the Colonies grant free railway passes to those living in country districts to enable them to reach the school nearest their homes. Certain stopping-places are arranged where children may join or leave the trains on their way to or from the schools. These public schools are divided into eight classes, determined solely by the average attendance.

Class	I.,	with average attendance of	over 800	pupils.
,,	II.,	,, ,,	601 to 800	,,
,,	III.,	,, ,,	401 to 600	,,
,,	IV.,	,, ,,	281 to 400	,,
,,	V.,	,, ,,	161 to 280	,,
,,	VI.,	,, ,,	81 to 160	,,
,,	VII.,	,, ,,	41 to 80	,,
,,	VIII.,	,, ,,	30 to 40	,,

When a public school reaches a certain standard of attainment it is known as a Superior Public School. With regard to the payment of fees, the systems vary. Elementary instruction is free in Victoria, Queensland, and New Zealand; fees are still paid in New South Wales, South Australia, and Tasmania.

The instruction given in all the Colonies is purely secular, but arrangements are usually made by which clergymen of the district visit the school and impart instruction in sacred subjects. Much dissatisfaction is caused in many places by the want of interest and energy shown by the clergy in availing themselves of this opportunity. In many towns, however, a regular course of Bible instruction is given by various visiting ministers. This phase of education has given rise to much vexed discussion, but up to the present that is how the matter stands. In South Australia the teacher may, if he pleases, read portions of the Holy Scriptures to such scholars as may be sent by their parents, for not more than half an hour before 9.30 a.m., but the teacher must strictly confine himself to Bible reading. In New South Wales 'secular instruction' is held to include general religious teaching. In all the other Colonies the subject is carefully avoided.

In a future paper I hope to say something of the teachers themselves, their salaries and opportunities for promotion; the inspectors and their work.

THE FLAVOURS OF FRUITS.—In a recent number of the *Comptes rendus*, Jacquemin gives some very interesting particulars of the results obtained by him with regard to the flavours of fruits. He finds that a very marked bouquet of the fruit is developed by adding the leaves of fruit trees which in themselves have no marked flavour to saccharine solutions undergoing alcoholic fermentation. When, for instance, pear or apple leaves are immersed in a ten or fifteen per cent. solution of sugar, and a pure yeast is added which by itself is the source of no marked flavour, a liquor is obtained after fermentation with a strong odour of pear or apple respectively. The flavour thus obtained is good, and when the liquor is distilled an alcoholic distillate results in which the aroma is still more marked. As vine leaves are found to act in the same way, Jacquemin suggests that in the case of a poor vintage the bouquet might be improved by the addition of some leaves during the process of fermentation. The results obtained by Jacquemin are much more marked when the leaves employed are from trees in which the fruit is approaching maturity. He is of opinion that the flavours of fruits are due to a body elaborated in the leaves, which is possibly of a glucosidal nature, and is not transferred to the fruits till the latter approach maturity. It is then acted upon by the special ferments contained in the fruit juices, and develops distinctive flavours. These investigations may possibly prove to be of commercial importance.

ELEMENTARY LESSONS IN AGRICULTURAL ZOOLOGY.

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CHAPTER XIII.

CLASS INSECTA—NATURAL ORDER LEPIDOPTERA.

THE fifth class of insects, *Lepidoptera*, comprises Moths and Butterflies, many of which are injurious in agriculture.

They may be readily known by their sucking mouth-parts forming a proboscis which is adapted for sucking honey, and is spirally rolled up under the head when not in use, and by the characteristic scales covering their wings. The proboscis varies in length. In a few species of hawk moths it is longer than the body. In species which do not suck honey the proboscis is short. The whole bodies of moths and butterflies are covered with hair-like structures developed by the skin. In the wings they partially overlap each other, are broader, and present a very beautiful appearance when viewed under a microscope. They are easily wiped off, when, the corresponding part of the wing is seen to be transparent and as clear as glass. The females of a few species of spinner and loopes moths are wingless, or only possess short flap-like wings useless for flight. In all the hawk moths and many owlet moths there is a wing hooklet, *i.e.* the hind wing has a spine or a thick brush, which grasps a band-like area of the fore wing, the two pairs of wings being held together in this way.

Moths and butterflies undergo a complete metamorphosis, *i.e.* they pass through a stage in which they are practically motionless, and in which they take up no food. The larvæ are true caterpillars and possess biting mouth-parts. The pupæ are *obtectute*, *i.e.* they are enclosed in a case which only faintly indicates the outline of the various parts of the adult insect. Many caterpillars creep into the ground to become pupæ and spin no investment at all, for instance, the hawk moths. Others form cocoons, consisting chiefly of silk secreted in a spinning gland and exuding to the exterior on the lower lip, but minute particles of sand and earth and fragments of wood gnawed off by the caterpillar may be stuck in the cocoon. The cocoon may be of firm texture, or may consist of threads quite loosely woven together.

The pupæ of butterflies are naked, *i.e.* they have no cocoon, but are fastened by threads to leaves, tree stems, walls, hedges, etc. They are said to be girdled when they are fixed by a silk band which surrounds them, and the head is directed upwards; and to be suspended when they are fastened to their resting place by the tip of the abdomen. The time during which the insect remains in the pupal stage depends partly on the species and partly on the time of year. The summer generation of the Large White Butterfly spends not more than fourteen days as pupæ, while the winter generation takes for the same stage eight months.

The families of Moths important to the farmer are the Owlet Moths, *Noctuidæ*, the Snout Moths, *Pyralidæ*, the Leaf-rollers, *Tortricidæ*, and the Leaf-miners, *Tineidæ*.

The *Noctuidæ* possess no very marked characteristics. They are night-flying insects, of medium size and dull hue with smooth-haired bodies. Their antennæ are long, thin, and thread-like (in the males of a few species they are comb-shaped), their wings powerful and arranged in a roof-like way when at rest. A wing hooklet is almost always present. Their flight is strong and rapid, but always occurs by fits and starts. While the owlets pair at night, they fly about also during the day even in bright sunshine. Almost all owlet moths lay their eggs separately and on herbs. The caterpillars are usually hairless. They mostly have five pairs of prolegs, but a few have four or three pairs. Several species are injurious to agriculture.

One of the most destructive moths is *Agrotis segetum* or *A. clavis*, the Common Dart or Parsnip Moth. It is a small moth, its length being ½ of an inch and its span of wing about 1½ inch. In colour it is inconspicuous, its fore wings being small, ash-grey or brownish with dark patchings and markings, while in the male the hind wings are bright grey to snowy white, and in the female brownish-grey.

Their caterpillars are from 1½ to 2 inches long, and are usually of an earthy-grey colour, though occasionally somewhat greenish in tint. The head and prothorax are darker. They have pairs of prolegs and a shining transparent external skin. They remain in the ground during the day, only feeding above ground at night and when the sky is much overcast. When touched they bend themselves into the form of a C.

The eggs of this species are laid at very different times, and are always deposited singly in the soil either in the neighbourhood of the roots of plants or else in the low-lying leaves and stems of various herbs. The caterpillars hatched from them are destructive earlier or later, according to the time of egg-laying. Many specimens are only half grown in winter, and in spring attack the roots of winter grain, winter rape, etc., or the fleshy underground parts of turnips and potatoes, or the roots of summer plants, summer grain, buckwheat, summer rape, vegetables, etc.

In 1885 their ravages were especially severe. 'In the autumn surface grubs were plentiful after the dry summer, and greedily devoured food of a varied character. It was difficult to escape these omnivorous insects, for no field and no crop was free from their inroads. Amongst transplanted leeks and cabbage they did most harm, yet they equally bit off, just near the top of the soil, turnips, spinach, onions, beetroot, carrots, lettuce, etc. Instead of describing which plants they prefer, it would be easier to say that there is no vegetable or herb they refuse. The late potatoes were damaged by them, and a fair piece of Magnum Bonums was attacked in such a manner that, though it would have been convenient to have allowed the crop to mature and ripen in the field, it was absolutely necessary to dig the produce to prevent the grubs eating them.'

Rooks are of great service in keeping down this pest in turnip fields. When very young these caterpillars can be dealt with by hand-picking, for they then feed chiefly above ground, choosing the part of the plant just at the surface of the earth between the root and the stem. When they grow larger they go further down and come up at night to feed. Lastly they attack the root itself, gnawing great cavities in it till it is consumed. After a bad attack of these caterpillars, thorough ploughing of the soil in October and sowing with winter grain is the best course to take. If swine are driven in during the autumn they will grub up and devour the caterpillars, fitting the land for sowing the following spring. Soft soap and kerosine, and gas-lime have been tried with success as means of destroying this pest.

The caterpillars of the Heart and Dart Moth (*Agrotis exclamationis*), and the Wheat Moth (*Agrotis tritici*), as also the thick-bodied surface caterpillar (*A. ravida*), resemble the caterpillars of the Turnip Moth in their habits, and may be dealt with similarly.

Another night-flying moth, the Cabbage Moth (*Mamestra brassicæ*), derives its name from the attacks the caterpillars make on cabbages. They are about 1½ inches long, and of a bright or dark green, brownish-green, or greenish-brown colour. The dark longitudinal stripe that marks their back is divided into halves by a narrow white longitudinal line. The brown pupa remains in the soil during the winter and is not invested with a cocoon. The moth appears in May. Its fore wings are of a glossy brown, marbled with yellow and black, each patch having a dark outline and being margined with a zigzag yellow line. The hind wings are of a shining yellowish-grey brown, and there is a strongly developed crest in the middle line of the thorax. During the day it rests on windows, etc. The leaves of cabbages, and sometimes those of lettuces and turnips, form the resting place for the eggs, which are of a yellowish-green colour and are laid separately. In a fortnight the caterpillars appear and begin to feed on the leaves. They are full grown within a month, and become chestnut-coloured pupæ in the soil. At the end of July and in August they emerge as moths, and lay the eggs of the second generation of caterpillars, which are even more destructive than the first, gnawing large holes down into the heart of the cabbage. Handpicking is the best remedy. Sprinkling with gas lime, exposed to the air for three months, has also been found effectual. Fowls are very fond of the chrysalids, but frost has no effect on them.

The Lettuce Moth (*Mamestra oleracea*) is smaller than the Cabbage Moth. Its fore wings, head, and thorax are of a dark rusty-brown dusted with white, its hind wings and abdomen of a reddish-white. The caterpillar, about 1½ inches long, is of a dirty greenish-grey colour dotted with white. They feed on cabbage, lettuce, asparagus, and other vegetables. Those of the first generation, hatched in June and July, hollow out lettuce stalks before the head begins to be formed; those of the second generation, hatched in August and September, feed on cabbage or asparagus leaves. The best remedy is handpicking.

A tiresome but seldom very destructive pest is the Pea Moth (*Mamestra pisi*). It is only about ½ inch long. Its fore wings are of a bright red-brown, with blue-grey markings and a yellow longitudinal streak; the hind wings of a reddish-grey. They appear in May and June, and their caterpillars are found from July to September on peas, beans, vetches, clover, lupins, sorrel, heath, willow, and birch. They are nearly two inches long, cylindrical and slender. The dark greenish or brown-red back is closely veined with dark lines, and there are two longitudinal sulphur streaks on the back and one on each side. The head, belly, and feet are flesh-red. When the caterpillar is touched, it moves the front part of its body about and then lets itself fall down.

The Grasstoot Moth (*Hadena monoglypha* or *H. polyodon*) is destructive through its caterpillars to meadow grass. Of a shining grey or reddish-white colour with a black head, they are about 1½ inches long and have sixteen feet. The yellow-brown moths lay their eggs separately on the bases of grass haulms and leaves towards the end of July and during August. At the end of August the caterpillars creep out, and especially after their hibernation, which comes to an end in April or May, they attack meadow grasses, biting through the leaves and haulms at their bases directly above the surface of the soil, and devouring as it were passages through the grass. The reddish-brown pupæ rest in the soil.

Another moth whose caterpillars attack grass is *Charœas graminis*, the Grass Moth, or Antler Moth. They are only an occasional pest, but then appear in such numbers and over so large an extent of country as to be quite a scourge. In 1884 they devoured every blade of grass for ten miles in Glamorganshire, leaving the mountains brown behind them, and in 1885 they destroyed the hill pastures in Ettrick and Yarrow. The moth is very small, being only ⅝ inch long. Its forewings are brownish with three whitish patches and darker markings, and its hind wings yellowish grey. The caterpillar, which has sixteen legs, is bronze colour with three narrow bright longitudinal streaks. During July the moth will lay two hundred eggs in little heaps at the bases of the grass haulms and leaves. In three weeks they are hatched. The caterpillars are very injurious during the autumn, and the next spring seem insatiable, always devouring the lowest parts of the haulms and leaves, so that the upper parts die. They wander in troops from one field to another. In June they become shining red-brown pupæ below the surface of the soil. When many miles of country are attacked by them, the best remedy seems to be to fire the surface, but when limited areas are infested, turning pigs on the land and ploughing the surface to turn the grass roots up with the caterpillars amongst them for the pigs to clear is the best remedy. Moles, shrews, rooks, wagtails, ducks, and fowls are fond of feeding on these caterpillars.

Occasionally, too, grass suffers from the attacks of the Couch Grass Moth (*Hadena basilinea*), but the caterpillars of this insect more frequently attack grain plants, especially on dry, high-lying land, where they do much mischief. The moth is about an inch long. Its fore wings and back are of a reddish-grey colour, the hind wings bright brown fringed with yellow. The caterpillar is 1½ inch long, bluish-grey colour, with dirty white longitudinal lines and greenish beneath. After hybernation they change in the soil into stout smooth yellowish-brown pupæ devoid of cocoons. When these caterpillars get into the crop, threshing should take place as soon as possible, or after hybernating they will continue to devour the grain in the barns.

(*To be continued.*)

INTERNATIONAL CORRESPONDENCE FOR TEACHERS.

LEARNING A LANGUAGE BY LETTER WRITING.

WE have much pleasure in reporting that the response to our appeals in the holiday numbers of this Journal has been decidedly satisfactory, and we have accordingly been able to send on a good batch of names of fresh aspirants to a share in the scheme of Anglo-French correspondence. We shall be glad to receive other names; for, though we have more than met the requirements of the French editors, as last reported to us, we have no doubt that the close of the holidays will be followed by a rapid accumulation of names of would-be correspondents on the other side of the Channel. As names are received at our office we shall continue to supply them to Messrs. Armand Colin & Co., with whom we shall co-operate to secure suitable pairing of the candidates.

To the September number of the *Contemporary Review*, Mr. Stead has contributed a very readable article, entitled 'The Latest International.' In this he tells with characteristic verve and vigour the tale of the rise and progress of the scheme which our friend M. Mieille has the credit of originating in its present form, and which owes much of its growing success to the encouragement and help given to it by Mr. Stead himself and his collaborator, Miss Lawrence, of Cambridge House, Wimbledon, who has very zealously and ably managed the business, in the *Review of Reviews*, as it does in France to MM. Colin et Cie, the proprietors of the *Revue Universitaire*. The article contains a kindly reference to the share of the 'PRACTICAL TEACHER' in extending the scheme to Teachers and older students.

It is needless here to recapitulate the matter of Mr. Stead's interesting record, for our readers have had the opportunity of reading month by month of the progress of 'the Latest International.' We may, however, quote the statement that 'there are at the present moment no fewer than 1,500 persons in France of both sexes who are now regularly exchanging letters every fortnight with an equal number of correspondents in the United Kingdom.' He goes on to say of M. Mieille, 'he is not a mere pedagogue, and behind this scheme of school-boy correspondence he saw, with the eye of faith, the dawn of a new international brotherhood.' It is to this aspect of the subject that Mr. Stead turns *his* optimistic eye, and on its possible future developments he descants with eager enthusiasm.

The remarks on subjects of correspondence are lively and laughable, and the specimen he gives of a French boy's English letter is so amusing that we trust he will pardon us for reproducing it. It runs—

> 'Dear Friend,
>
> 'I think that I can give back me to your good invitation, but I go in England during the holidays, strive to go all same self even London. You have been much in the feasts of all these time to the occasion of the Jubilé, and I understand you have not written at the time, so I excuse you. If you must send me an English newspaper speaking of the Jubilé, I send you by the guardhouse the photographies of the sights of this city and the principal monuments.
>
> 'I go from W—— to-day to pass the holidays of the fourteen Juili (the national feast) we have to days of holidays at the occasion. W—— is a little coast town where my great fathers have two Swiss cheese houses, each year we go down yonder for pass the great holidays. The coast is so beautiful and become so worldly. Make you much of velocipede in this moment? What stamp have you? I hope receive a letter of you the twenty-one Juli and in this expectation receive dear comrade a hearty shake of the hand of your sincere friend P.'

From M. Mieille, whom we are coming to regard as a personal friend, we have received a long letter full of earnest hopefulness as to the extension and the fruits of the scheme which he works for and watches over with such keen interest. He informs us that on the 1st of October he is going to enter on an important new appointment as teacher of languages at the *Lycée* of Farbes, a large town in the south of France, and that Madame Mieille has a similar appointment at the same place. We are sure our readers will join us in congratulating them both on their well-earned promotion.

This fact gives special interest to a speech delivered by M. Lafage at the Prize Distribution at the College of Draguignan on July 30th. As likely to interest our French students, we quote the passage relating to M. Mieille:

> 'Un de vos jeunes et distingués professeurs, M. Mieille, a trouvé un moyen tout à fait ingenieux de rendre l'étude des langues étrangères aussi profitable qu'attrayante. Il a imaginé et organisé un système de correspondance entre écoliers de toute nationalité; Français, Anglais, Allemands, correspondent avec ardeur, chacun dans la langue de son voisin; l'idée féconde de M. Mieille a déjà produit d'excellents résultats pour le perfectionnement des langues; il est permis d'espérer que son action bienfaisante s'etendra plus loin encore. Un courant de camaraderie et de mutuelle sympathie s'est déjà établi entre les jeunes correspondants; peut-être verra-t-on un jour sortir de là une sorte de rapprochement international. Quand, de peuple à peuple, les enfants sympathisent, croyez-vous que les pères soient si loin de s'entendre? Et plus tard, quand les enfants seront devenus des hommes, pourquoi ne continueraient-ils pas a correspondre et ne finiraient-ils pas par vider leurs différends non plus à coups de canon mais par un échange de correspondance? C'est à vous, jeunes élèves, et aux élèves de l'avenir, qu'il appartient de concourir à la réalisation de cette belle espérance. Profitez de vos vacances pour entretenir avec vos jeunes correspondants de l'étranger une correspondance encore plus active. Ne vous contentez pas d'écrire, allez converser avec eux et consolider ainsi de vive voix ces liens de confraternité scolaire qui, grâce à vous et à vos successeurs, seront peut-être un jour la première ébauche de cette confraternité humaine rêvée par les poètes et les philosophes.'

Our Monthly Retrospect

EDUCATION IN ENGLAND.

BY T. B. ELLERY, F.R.G.S.

1895–6 *President of the National Union of Teachers.*
Chairman Teachers' Benevolent Fund.

Mr. C. Bowden for the London School Board. Members of the N.U.T. will be glad to know that Mr. Charles Bowden, the 1893–4 President of the Union, has consented to become a candidate for a seat on the London School Board at the

MR. CHARLES BOWDEN.

next election. If ability and a complete grasp of all educational matters count for anything, he will certainly be returned. For many years, as my readers are probably aware, he was the head master of the Wesleyan School, Gateshead. The managers of that school, some time ago, took certain steps to which Mr. Bowden, from principle, objected, and in the end he severed his connexion with Gateshead, and made a new home in London, where, as author and publisher, he still keeps in touch with school life. No man is better qualified for a seat on the Board than he; no man, I think, knows more of teachers and schools than he does. I heartily wish my colleague and friend all the success his Finsbury supporters wish for him, and trust to see him at or near the top of the poll.

His long experience on the Executive of the N.U.T. as a member of various committees, as President, and now as Chairman of the Technical and Secondary Education Committee, and Chairman of the Finance Committee of the Benevolent Fund, should stand him in good stead. Finsbury, I am convinced, is not at all likely to miss the opportunity of securing the services of such an able, all-round man as Mr. Bowden has proved himself to be. At the right time, willing workers on his behalf will be in the field, for he is as popular as he is able, and that is saying a great deal.

In the "Land of the Thousand Lakes." Now that I am referring to Mr. Bowden, I cannot refrain from telling a little story in which he played a part. He will forgive me, I am sure. He and I were once taking a holiday together at Trolhatten, between Gothenburg and Lake Wener. We were innocent of the language of the country, a fact which led to several 'adventures,' more or less exciting, and more or less amusing. The famous Falls had interested us so much we wanted to see more of the neighbourhood, and decided to hire a conveyance for an hour or so; but we could not convey our wishes to the proprietors of the hotel. My companion tried his best pantomime, and was eloquence itself in his dumb-show; still, our combined efforts were a complete failure, and when dismay could be seen on the faces of the good people, I began to fear the worst! Mr. Bowden, however, was equal to the occasion. Taking a piece of paper and a pencil from his pocket, he rapidly dashed off a few strokes which, he assured me, represented a horse and carriage, and in a moment our difficulties were over.

Thus does art come to the rescue at a critical time. It only remains for me to say that, whether engaged on holiday or on more serious business, Mr. Bowden is an excellent colleague and the prince of good fellows.

The "Orphan" and "Benevolent" Joint Report. Subscribers to these funds have, by this time, probably received the first joint report of the Council and Committee. Up to the present each fund has issued its own report. Now it is a joint publication, and the change is an admirable one in every way. One can see at a glance the individual subscriptions to each fund, which will, I imagine, be a great saving of time and labour to the various officials and to the committees. Moreover, the two societies are, in essence, one, so that separate reports are entirely unnecessary. One wonders that the old plan has been continued for so many years. The report is a most interesting one, showing as it does a remarkable growth in the resources and operations of this branch of the N.U.T. in recent years. I hope to be able to deal with some points in it on another occasion. In the meantime, my hearty congratulations to the subscribers and the committees.

Electoral Districts. For good or evil the change has been made, and the next election of the N.U.T. Executive will take place on the new system. The country has been divided into twelve districts (London taking three), each returning three members.

Conference instructed the Executive to prepare the scheme, and I believe every effort has been put forth to produce one that will give satisfaction. It is too much to expect that it will be above criticism. Possibly the next Conference will make serious changes in its details, but, under all the circumstances, the scheme prepared is as good as the most exacting member of the Union could expect it to be. It remains to be seen whether the new system is an improvement on the old one. Hitherto, the election has been national; it will now be narrowed down to localities, and I fear it is more than possible that local feeling, local competition, local jealousies may lead to undesirable results. However, the arguments for the change are probably stronger than those against it, and in any case, the die having been cast, we must all do our best to see that the new system has a fair trial. The question now being generally asked is: How many of the present members of the Executive will be found at Russell Square after Easter 1898?

Examination of Pupil Teachers by the N.U.T. } It will be generally conceded, I think, that the new departure of the Executive in instituting quarterly examinations of pupil teachers deserves support. Having seen the whole of the papers set, and having gone carefully into the whole of the arrangements, I am in a position to say that the work is thoroughly well done. Head teachers will find the scheme a great assistance in every way, and I am convinced the young people themselves will materially benefit by it. Already an excellent start has been made, about 250 pupil teachers having been examined on the last occasion. Those who wish for details should apply to the General Secretary of the Union, who will gladly send particulars. The Honorary Secretary is Mr. A. A. Thomas, B.A., whose self-sacrificing devotion to the work is beyond praise.

Mr. Whittaker's New School. } The Rev. H. C. Squires has stuck to his guns, and Mr. Whittaker's connexion with Holy Trinity Schools, Richmond, has ceased. Perhaps Mr. Squires imagined that this would 'close the incident.' If so, recent developments must have been a rude shock to him. The parents themselves have moved in the matter, they are incensed at the treatment received by the master, whom they regard as 'a capable and upright man,' and they have determined upon securing fair play for him. When the schools re-opened after the holidays one-half of the scholars were absent, and other difficulties cropped up during the week.

An obvious duty was thrust upon the Executive of the N.U.T., and that was to open another school in which Mr. Whittaker could continue his work. Temporary rooms have been secured, the dismissed master has a good staff, good apparatus and about 150 scholars, the outlook is most encouraging, the parents are loyal, and the inhabitants generally are with us. I have received a copy of the *Thames Valley Times* of September 8th, in which the editor challenges the Vicar of Holy Trinity and his colleagues to publish a full report of the interview between the Rev. H. C. Squires and Mr. E. Gray, M.P.

For many reasons I hope the challenge will be accepted, but the editor is clearly of opinion that they dare not publish the full report asked for. We are evidently in for a big fight, a fight for fair play and justice, which sooner or later, I am certain, will be secured for Mr. Whittaker. Teachers all over the country will be grateful to Alderman Thompson, so well known to Conference-goers, for the interest he has taken in this sorry business and for his manly support of a brother teacher in the hour of trial.

A Voluntary School Rate at Richmond. } My readers probably know that the Richmond Town Council makes a *voluntary* rate in aid of Holy Trinity Schools. So strong is the feeling in the town in favour of Mr. Whittaker, that it was hoped the Council would either hold its hand for the present in the matter of this rate, or would apply a portion of the receipts to the support of the new schools. However, on the 14th September the Council, by a majority of 25 to 10, passed a resolution making a threepenny rate in aid of Holy Trinity Schools, postponing a similar resolution in aid of Mr. Whittaker's School. I am assured that many will refuse to pay the rate, and that a town's meeting will be held as soon as possible.

A Bishop on Church Schools. } The Bishop of Peterborough, preaching at Leicester on a recent Sunday evening, on behalf of the local Church Day Schools, said that unless Church people made it a matter of Christian principle to help to educate their young it would be a difficult matter to keep up their day schools. He would not for a moment speak disparagingly of any system of education, but he would say that the elementary education given in their Church Schools was, in regard to the things of this world, as good as any other system, and better than any other system in regard to the things of the world to come. That being the Bishop's opinion, the least one can expect of him is to see that the salaries of Church School teachers in his diocese shall compare favourably with those received by their School Board colleagues.

The Church Programme at the coming L.S.B. Election. } The Church party seems to be hopelessly divided as to what shall be the programme at the next London School Board Election. Mr. Evelyn Cecil, in the *Times*, suggests that it shall be (1) the Apostles' Creed in the syllabus, and, of course, really taught in the schools, to ensure that the Christian teaching shall be truly Christian in its character, and (2) the use of separate class-rooms for any denomination desiring them in order to give definite religious instruction to children whose parents desire it. One Church paper, I see, says: 'These suggestions are practicable and fair, and might well receive the assent of all Christians.' But doesn't it look as if the battle to be fought will be one between members of Mr. Diggle's late 'party'?

The exhibition they have made of themselves is a sorry one, to say the least of it. What measure of support can the members of that 'party' expect to receive while this miserable business continues?

The Aycliffe Case. } When Mr. Thompson was dismissed in 1894 from the Head Mastership of the Aycliffe School by the Rev. C. J. A. Eade, Mr. Organ, one of the standing Counsel of the N.U.T., said the Law Committee of the Executive of the Union had determined to bring the case to a successful issue at whatever cost, either of money or energy. A correspondent has drawn my attention to this, and asks what is being done. I am glad the opportunity has been given to me of stating that the Law Committee and Mr. Organ have not forgotten their assurances of 1894. The people of Aycliffe, too, have shown in a hundred ways their devotion to Mr. Thompson. A new school is being built in which to house Mr. Thompson's pupils, and I hope soon to be able to announce the date of the opening. A red-letter day is, I believe, in store for the people of Aycliffe, but details must be held over for the present.

Some of the Law Cases of the Union. } On a former occasion I said in these columns that membership of the N.U.T. was the best "Insurance against Accident" a teacher could possibly have. If the details of the work done by the Law Committee could be set out on paper, and thus made known to the teachers of the country, the statement would be accepted without the least hesitation. Let me give a few recent cases, considered, *with many others*, at one meeting of the Committee.

1. A scholar stole a chair from a desk. The mother brought the chair back, used abusive language to the mistress, and finally struck her on the face—a little amusement on the part of the parent which resulted in an appearance at the police court at the invitation of the N.U.T., and a 'fine and costs'—which proved to all and sundry how expensive some little amusements really are!

2. A scholar was punished, after which the father paid a visit to the school, abused the mistress, and struck her. He, too, found the game a little expensive, and will probably in future adopt some other form of amusement.

3. An assistant master in London had occasion to punish one of his scholars, who, after the punishment, ran home. The mother proceeded to the school, and after a 'few remarks,' more or less complimentary, dealt the teacher a blow on the face. Result, a fine of 10*s.* and costs.

4. A girl was sent out for punishment, but was neither punished nor detained after school hours. Here again the parent indulged in abuse, and struck the mistress. There was the customary subsequent visit to the police court, and the usual 'fine and costs.'

It is, perhaps, unnecessary to give other cases. Those I have mentioned should convince non-members, especially ladies, how unwise they are in holding aloof from the Union fold. With a membership of about *forty thousand*, the Executive makes no appeal to outsiders, but the doors are still open and there is room for all. *Verbum sat sapienti.*

PORTFOLIOS for holding Twelve Monthly Numbers of the 'PRACTICAL TEACHER,' Extra Cloth, specially fitted with strong Elastic Bands, price Two Shillings Post Free from this Office.

EDUCATION IN SCOTLAND.

BY JAS. PATERSON,

Vice-President of the Educational Institute of Scotland.

Lord Balfour at Clackmannan. Lord Balfour of Burleigh delivered an address on educational affairs at Clackmannan the other day on the occasion of the opening of a new public school. His Lordship dealt with the matter of educational expenditure and results, and alluded to the consequences of the irregular attendance of children at school. He pointed to the responsibility and duty of parents in this connection, and ventured to say to the general public that when things went wrong, when they did not get all the results they ought to get from educational expenditure, they should not always blame the Department, the School Board, or the teacher, but consider whether those who had, after all, the most permanent interest were really doing all they could to help the machinery which they had set up.

Putting Children Back. The practice of putting children back to a lower standard during the course of the school year, which is occasionally found to be necessary in the interests of the children themselves, is sometimes called in question by an indignant parent, and even a learned sheriff and an inspector of schools have recently expressed themselves as opposed to the practice. No one will deny that the proper time to keep back a child, who is known to be unfit to go forward, is at the beginning of the school year. It not infrequently happens, however, that a boy or girl, who is quite capable of going on with the rest of the class after the inspection, falls hopelessly behind through long-continued absence or grossly irregular attendance. In such cases teachers would assuredly fail in their duty by retaining the children in a class from the instruction in which they were unable to profit.

Burgh and County Bursaries. The Burgh and County Committees' Bursary schemes seem, according to some at least of H.M. Inspectors, to be bearing good fruit. While the schemes of some committees provide grants to all schools which produce satisfactory results, in most cases the pupils are obliged to leave their own schools as a condition of holding a bursary, and to attend some central board or secondary school. Where a school has not a sufficient number of advanced pupils to occupy the time of one teacher there is much to be said in favour of drafting them to a fully-equipped central school, but to remove children who have just passed the fifth standard, and for whose further teaching there is ample provision, from a code school to a purely secondary one, and that for only a two years' course of instruction, as is done under some schemes, is certainly not in the interests of the pupils themselves, while it is as certainly injurious to the school from which they have been removed. The writer has reason to know that these views are shared by many of the most experienced of H.M. Inspectors.

Infant Departments. Infant Departments, we are informed by H.M. Inspectors, now form part of all the larger and better organised schools, and these gentlemen are unanimous in according great praise to the Infant School teachers for the enthusiasm and success with which they perform this most important part of school work. The teaching, they tell us, is based upon a true knowledge of child nature, and the more solid subjects are suitably varied with kindergarten occupations, musical drill, and other recreative movements. The pleasurable nature of school life under these improved conditions is manifest to inspectors in the happy faces of the children, and the zest with which they enter into their various exercises. Is not the high state of efficiency of Infant Departments, to which admiring reference is so frequently made by H.M. Inspectors, a strong argument in favour of extending to the teachers of the older scholars that freedom from rigid standard requirements which is undoubtedly one of the chief causes of the great advance in recent years in Infant school instruction?

Science and Art Grants. The satisfaction felt at the announcement made some months ago that the administration of Science and Art Classes in Scotland had been transferred to the Scotch Education Department has been rudely dispelled by the first act of the newly constituted authority. It was fully expected that the sweeping changes proposed for the payment of grants would have been delayed until after full consideration of the circumstances and requirements of Scottish Schools. Strong representations were made to the Department, but these have been disregarded, and, according to a circular issued on 18th August, 'My Lords do not find themselves able to continue the option longer in the case of Scotland.' That is to say the new scheme in its crude state comes into operation immediately. Its operation spells ruin to numberless Science and Art classes. The grants at best will be only three-fifths of the former amount, and there are conditions attached of a most objectionable character. It is not pretended that the scheme is a final adjustment. Why then should it be rushed on the country in this hasty manner? Science Committees have made no provision to cope with the changed circumstances, as it was confidently expected that the Education Department would take a sensible view of the matter, and proceed with caution.

Admission to Training Colleges. The Glasgow School Board has made a representation to the Scotch Education Department on the subject of the admission of students to training colleges. The Board suggests (1) that the existing method of selection, which makes the admission of candidates depend on their choice of a training college instead of their position in the examination list, should be terminated; (2) that the number admitted to the training colleges each year should be considerably increased, the demand for teachers having become much greater since the present number was fixed; and (3) that, in view of the long interval elapsing between the Queen's Scholarship examination in December and the admission of successful candidates to the training colleges on 1st October, arrangements should be made for holding the examination about the month of April. The Chairman stated that the first grievance would be greatly lessened by the determination of the committees of the three training colleges to admit no second class student till the first class list had been exhausted. Dr. Ross thought they had far too many pupil teachers. He also thought the Department should devise some method for the classification of students with leaving certificates or university preliminary certificates.

Sale of Books in Board Schools. Dundee School Board has had under consideration a motion to the effect that the sale of books and stationery within the schools should be discontinued. In moving the previous question a member pointed out that, while increasing the efficiency, the sale of books in several schools was an absolute necessity, as otherwise the grant would be reduced. In answer to a question the treasurer stated that, as far as he knew, there was no profit to be made by any teacher, and all accounts were sent to him except for small articles of stationery. Eventually the matter was remitted to the Finance Committee for consideration.

Assistant Teachers' Association. The Dumbartonshire branch of the Scottish Assistant Teachers' Association held a meeting lately at Renton. Mr. Robert Paterson, M. A., read a paper on "A Substitute for Superannuation." The principles he advocated were akin to those of a friendly society, based on mutual self-help. The essayist referred to a similar society in the medical profession, and urged the immediate necessity for action of some kind being taken by teachers. Although statesmen were not adverse to the principle, the details were matter of great difficulty, and likely to be so for a long time. Mr. Paterson seems not to be aware that several years ago a fully detailed scheme of superannuation for teachers was prepared by a body of experts appointed by the Education Department. It is this scheme which the E.I.S. has been pressing, and must continue to press, upon members of parliament till it is passed into law. The Departmental scheme has the obvious advantage over Mr. Paterson's 'substitute' that it would be subsidised from imperial funds, and would cost the teachers nothing for management, being under the charge of the Education Department.

Inspection of Higher Class Schools. Sir Henry Craik's report for the year 1897 on the inspection of higher class schools in Scotland has been issued. It states that the higher class schools inspected were 77 in number, and that, on the whole, the results continue to be satisfactory. The inspection of these schools, Sir Henry says, has undoubtedly put an end to much that was faulty in organisation and defective in method. The attention of school authorities has by its means been directed to cases which called imperatively for reform, and it has shown the difference between sound and specious work. On the question of staffing he says it cannot be too clearly understood that a staff, which in point of numbers, was adequate to requirements in the past cannot be expected to cope with the variety and scope of a curriculum widened to meet the needs of the present day. He is somewhat severe on the habit—common, it would appear, amongst parents even in secondary schools—of removing scholars at an unduly early age, and in some cases of allowing scholars to begin the summer holiday before the close of the school session. It is beyond a doubt, he says, that the weak point of the day-school system, as compared with that of the boarding-school, is its liability to be subject to private domestic arrangements, and that, if it is to have a fair chance, it can only be by each parent feeling that he has a duty to his son and to the school, and that nothing but gross selfishness and carelessness can permit him to set that duty aside for the sake of personal convenience.

Leaving Certificates. On the subject of the Leaving Certificate examination also Sir Henry Craik has issued his annual report. He has again to report an increase in the number of candidates presented for examination. From the large increase of 67 in the number of schools from which pupil teachers only were presented, it is evident that the leaving certificate examination is being adopted more generally as a means for qualifying for the earlier stages of a teacher's career. There has been a slight reduction in the proportion of passes obtained when all the subjects are reckoned, but Sir Henry points out that this result is not due to any marked or undue raising of the standard this year, but is rather to be attributed to the large number of unprepared candidates, some school managers and teachers evidently not fully realising what the standard is. Apart from the percentage of passes, the reports received from all those who have taken part in the revision show that there are some features of improvement accompanying the increase in the number of candidates. That the examination has commended itself to school authorities and teachers is proved by the fact that all the higher class schools in Scotland, with a very small number of exceptions, present candidates for the certificate.

THE NEW PRESIDENT OF THE EDUCATIONAL INSTITUTE OF SCOTLAND,

HUGH CAMPBELL, ESQ., M.A., LL.D., F.E.I.S.,

Rector, High School, Falkirk.

THE unanimous selection of Dr. Campbell as President of the Educational Institute of Scotland, the highest honour within the reach of a Scottish teacher, has given great satisfaction in all educational circles. It would be difficult to find a more able, a more scholarly, a more enthusiastic teacher and educationist within the ranks of the profession. A many-sided man, full of life and fire, a genial and most attractive personality, he possesses in a remarkable degree that strange magnetic force of personal influence which is the special gift of the born teacher. Far removed from the old Dominie School, so wickedly described by someone as *Arma virumque cano*—'arms, and the man with the cane'—he is a teacher of the best type, a man with a heart as well as a head, who understands young people, appreciates their difficulties, and has the knack of stimulating intellectual exertion and creating in his pupils a genuine desire for knowledge. A man in the prime of his physical and intellectual powers, well able to combine the culture of other days with the special wisdom of ours, and ever in the front rank of educational movement, no happier choice of a President could have been made.

Dr. Campbell, who was born in 1846, is intimately connected with the schoolhouse, which may to some extent account for the fact that he is a teacher to the manner born.

DR. CAMPBELL, PRESIDENT OF THE E.I.S.

His maternal uncle, Mr. Stewart, was one of the most prominent parochial teachers in Perthshire in his day; his uncle on the father's side was Professor Campbell, long and honourably connected with the English Presbyterian College. A lad of unusual promise, he gained the English prize in his first secondary school under the Rev. Robt. Fisher. He was a favourite pupil, in the Dundee High School, of the late revered Dr. Lowe, for many years Rector of the Grammar School, to whom as a teacher and a friend he owes many obligations. Under Dr. Lowe in after years he commenced his life-work as a teacher. While yet only fifteen years of age he went—after the time-honoured Scottish fashion, which wasted no time in matters educational—to the University of St. Andrew's, obtaining there a Foundation Bursary on his entrance. Here he studied to such good purpose that in addition to numerous class-prizes, he carried off, at the close of the first and fourth sessions, the Miller Prize, which was instituted to encourage a wider culture than the Universities of Scotland at that time encouraged and provided. The subjects of examination included not only the classical and other university subjects then taught in St. Andrew's, but also history and modern languages. Two professors in particular greatly influenced him—Professor Flint, whose enthusiasm, laborious industry, wide knowledge and keen dialectic made every kindred spirit a philosopher; and the Rev. Lewis Campbell, whose nobility of character, warm-hearted sympathy and exquisite literary feeling, combined with Platonic and Sophoclean scholarship, inspired the young student with a double portion of his own enthusiasm for Greek philosophy. Professor Campbell's winged words and keen appreciation of all that is noble and beautiful found a favourable field and are bearing good fruit in his former student to-day.

In 1866 Mr. Campbell graduated as Master of Arts, obtaining the Tyndall-Bruce Scholarship for distinction in Latin and Greek, in accordance with the conditions of which he attended a post-graduation course at the University of Edinburgh, under Professors Sellar and Blackie. His abilities as a classical scholar won for him other exhibitions at New College, London, and in 1880 led to his appointment as Examiner in Classics in the University of St. Andrew's. His intimate acquaintance with patristic literature was shown by his scholarly translation of Arnobius, one of the volumes of the well-known Ante-Nicene Library—a task which drew from the 'Athenæum' a most favourable review.

In other departments of knowledge Mr. Campbell's university career was almost equally brilliant. In English literature, mathematics, natural philosophy and chemistry he had the satisfaction of winning the commendation of Professors Baynes, Fischer, Swan and Heddle. Professor Baynes stated that he was one of the most distinguished students of his time, and Professor Campbell described him as one of the ablest and most thorough-going examiners the University had ever had. In 1888 the honorary degree of LL.D. was conferred on him by his *alma mater*. During two terms of office he has acted on the Joint Board of Examiners of the Scottish Universities. As a member of the Board Dr. Campbell prepared an elaborate report on the conditions imposed on students of medicine in the various universities of the Colonies, so as to provide a basis on which to determine what examinations should be held equivalent to those conducted in Scotland. For this report he received the special thanks of the Board.

In his twentieth year he was appointed classical master in the Edinburgh Collegiate School, and during his residence in Edinburgh with characteristic energy he devoted himself to work of various kinds, being a director of the Choral Union and occasionally doing literary work for the Messrs. Nelson and the Messrs. Clark. Proceeding to New College, London, fresh honours awaited him. The Harris and Williams Scholarships and the distinction of Selwyn Essayist followed in rapid succession, and he found time to do much good work in the British Museum, as well as to pay visits to the National Library in Paris. After several years spent in England, Dr. Campbell accepted an appointment to Stranraer Academy, where his services were very highly appreciated.

In 1886 he was appointed first Rector of Falkirk High School, a new school originated by the praiseworthy enterprise of the School Board to meet the wants of a rapidly growing town and district. There he had to contend with difficulties that would have overtaxed the powers of most men, but his indomitable energy has triumphed over every difficulty. During the eleven years he has conducted the school, he has secured year after year the warmest eulogies from H. M. Inspectors and the statutory examiners of his school. The voice of the whole neighbourhood bears ungrudging witness to the fidelity, skill, and success which have crowned his labours, and his numerous friends will be glad to learn that a very handsome and completely equipped new school is about to be opened, costing no less than £12,000. Last year the parents of his pupils honoured themselves, as well as Dr. Campbell, by presenting him with an address in recognition of his success as a teacher and his personal worth as a citizen.

In the Educational Institute of Scotland, of which Dr. Campbell was made a fellow in 1891, his name is a household word. Before coming to Falkirk he was elected President of the Wigtownshire Branch, and the Stirling brethren called him to the chair in 1889. His year of office in the Stirling Branch was marked by very valuable work in framing the science and the pupil teachers' schemes. In 1892 he was made a member of the General Committee of the Institute, which has year after year elected him to the Special Committee. His labours in the Sub-Committees on Higher and Technical Education are too well known to be mentioned in detail. He was also Convener of the Evening School Committee, and not a few of his suggestions are embodied in the code which regulates this important branch of popular education. The appearance in 1892 of what may be called an epidemic of harsh and arbitrary dismissals, induced Dr. Campbell to move the institution of the Emergency Committee, of which he has remained a trusted and zealous member ever since. As might be expected, Dr. Campbell being a most effective speaker, his services have been much in request all over the country. He has read papers all over Scotland from Beauly to Hawick, as well as at the congresses in Stirling, Paisley, Galashiels, Glasgow and Aberdeen. He has most ably represented the Institute at representative conferences with the English and the Irish brethren. He has also taken his full share of the work of the Institute's Board of Examiners.

Dr. Campbell finds time somehow for much work of a local and philanthropic kind. When the Falkirk Free Library was established he was appointed one of the committee for the selection of books. Under his guidance there has been formed the nucleus of an exceedingly useful educational section, which is steadily growing.

The Educational Institute is to be congratulated on its selection of a man of wide culture, solid attainments, sound judgment and great business capacity, coupled with keen insight, untiring enthusiasm, unfailing geniality, and consummate tact.

THE EDUCATIONAL INSTITUTE OF SCOTLAND.

SEPTEMBER MEETINGS.

THE Educational Institute of Scotland, unlike its sister association, the N.U.T. across the Border, is not content with holding one great meeting during the year. It needs must have two. The Congress held during the New Year Holidays changes its place of meeting; the determining factor being to a large extent the district to which the President for the year belongs, but their Annual General Meeting is always held in Edinburgh in September, in accordance with the Royal Charter. These two gatherings perform totally different functions. The Congress is designed to educate the general public on matters of educational and professional importance, while the September Meeting is intended for the transaction of Institute business.

Taking advantage of the large number of teachers, who are attracted to Edinburgh at this time, other associations hold their meetings either on the Friday preceding or early on the Saturday. First in point of time is that of the

Schoolmasters' Widows' Fund.

The meeting of the trustees of this fund is never a large one. The Act now in force which compelled Scottish Schoolmasters to make provision for their widows and orphans received the Royal Assent on July 16th, 1846. The President, Mr. Bell, Yarrow, in the course of his address sketched the growth of the fund from 1837 to 1872. In 1837 the number of contributories was 1047, and the capital fund amounted to £44,124. In 1872 the number was 1345, and the capital £117,158. Since that year no new entrants have been admitted, so that the numbers now stand at 473, and the capital at £105,019. 319 annuities ranging from £41 5s. to £8 5s., have been paid during the year. To those of us who are advocating on all occasions a pension scheme it is interesting to note that the fund is entirely managed by the teachers themselves. Who will calculate the value of such a fund on the work of the 'Old Guard'?

Immediately after the above meeting, the

Burgh and Parochial Schoolmasters' Association

meets under the presidency of Mr. Donald, Muirkirk. In his address the chairman points out that in 1872 there were 999 parochial teachers, to-day there are about 200 still at work. Their numbers gradually dwindling, though their work still remains. The Treasurer reports that 6 pensions, varying from £250 to £60 have been granted by School Boards. May the day speedily come when all teachers can look forward to a superannuation scheme at least as good as that which the 'Old Parochials' have, thanks to their organizing themselves so thoroughly after the passing of the Education Act in 1872.

After a few years' migration to the more fashionable North Side, the members of the

Currie Club

return to hold their 38th Annual Meeting in their old haunt, the 'Drawing Room' in Chambers Street. The President, Mr. Mackay, Edinburgh, gives a succinct address on the changes in the administration of schools during the past 25 years, and, in conclusion classifies the subjects taught in schools in order of their importance. Reading and Writing, he says, may be called the Literature of the common people; Arithmetic their Mathematics or Logic; Drawing and Music their Art; Geography their science; and History and the Bible their Philosophy or Ethics. Mr. Mackinlay, the respected rector, being absent in the country continuing his convalescence after a severe illness, conveys his best wishes to the Club by letter. Greetings with Moray House are interchanged. A thoroughly enjoyable musical programme is

given, and one of the most pleasant meetings of the Club is concluded by the singing of 'Auld Lang Syne.'

At the same time the

Moray House Club

held its annual conversazione in the Students' Hall of the College. A large gathering of the members, who now number over eleven hundred, renewed the associations of bygone years over the preliminary cup of tea and afterwards spent a pleasant time together, the business matters of reports and elections being interspersed with music. Mr. Alexander, the retiring President, in his address gave some points of contrast between the schools of sixty years ago and those of to-day, and afterwards nominated as his successor Mr. Matthew, of Corstorphine, a choice which seemed highly popular with the Club. During the year a beginning has been made in the way of honouring the Founders of the Club by presenting the College with their portraits to hang in the large hall. Those already hung represent Mr. Russell, late Editor of the *Schoolmaster*: Dr. Kennedy, late Clerk to the Glasgow School Board; Mr. Ramage, late Rector of the Aberdeen F. C. Training College; and Dr. Paterson, the present esteemed head of the Moray House College. Delegates were present from the Currie Club during the evening.

Prior to the Institute meeting on Saturday, the

Scottish Assistant Teachers' Federation Council,

under the able presidency of Mr. McCallum, Glasgow, disposes of some important business. The report showing a membership of 3,687—an increase of 455 over last year—is submitted and approved of. The energetic Secretary, Mr. Fenton, Aberdeen, touches on the more important points likely to occupy the attention of assistants during the ensuing year. Among these is the compilation of an up-to-date Comparative Statement of Salaries, which, along with an ideal scheme, it is proposed to publish at once, and place in the hands of the various School Boards. Punctually at eleven the bell announces the opening of the 51st

Annual General Meeting of the Educational Institute of Scotland.

There is a very large attendance, though not quite so large we think as that of last year, no doubt due to the fact that there is no stirring election to take place. The necessity, however, for a larger place of meeting is becoming every year more apparent, because of the increased and rapidly increasing membership of the Institute. We have hardly secured our seats when President Adams, accompanied by the senior Vice-Presidents and other dignitaries of the Institute enters. The meeting constituted, and standing orders adopted, Mr. Adams is ready to deliver his valedictory address. As is confidently expected, he strikes out a new line from that of his predecessors. Instead of giving a review of the year's work, he confines his attention to the consideration of the question of

Tenure of Office.

based on the preparation and presentation of a petition to the Right Hon. A. J. Balfour on the subject by over 8,200 teachers. What the teachers of Scotland want, he says, is *some* court of appeal against unjust and capricious dismissals—the Department, the Sheriff, the County Council—any responsible body that will take disputes out of the region of petty parish politics, and have them decided on equitable principles. Further, we want this court *now*. He then proceeds to show that teachers require this protection more than others, for four reasons. In the first place, teachers are frequently reminded that they are the servants of the Board. They are the servants of the *public*, just as the Boards themselves are. Boards and teachers have a common master whose interests alone are to be considered.

Again, teachers may claim that they are already exceptionally treated, for from the pupil teacher stage to the day when they *ought* to receive pensions they are in the grip of the Department. In the third place because, in teaching, a dismissed man is a ruined man; and lastly, because the lack of tenure of office seriously interferes with the efficient discharge of their duties. He asks how long it will take the public to learn that teachers do not object to dismissals. But *capricious* dismissals they cannot and will not stand. He sums up his able, clear, and thoroughly practical address by saying that all that we teachers want is to be allowed to do our work without fear or favour, knowing that as long as our public work is well done our public appointment is secure.

The New Officials.

In demitting office he names as his successor the unanimous choice of the Institute, 'an experienced man of affairs, a ripe scholar, an enthusiastic teacher, and an eloquent orator'—Dr. H. Campbell, Falkirk High School, who, in a few well-chosen words, accepts office.

Mr. Dunlop, ex-President, in moving a vote of thanks to Mr. Adams, pays a high compliment to his great energy and enthusiasm in the conduct of the business during the year.

Mr. Ingram, Wishaw, and Mr. McKenzie, Aberdeen, are elected Vice-Presidents, and on the motion of the President Mr. Laurence is re-elected Secretary.

Finance.

Dr. Mackay, in presenting his financial statement for the year, shows that £973 12s. has been received as dues of membership, and that £110 5s. 8d. has been made out of the Medical Preliminary Examination conducted by the Institute. He is thus able to report a very favourable balance in favour of the Institute of £509 1s. 0½d., while the state of funds shows an aggregate of £3,921 19s. 6½d. A breezy discussion takes place; among those who take a prominent part in it is the irrepressible Aberdonian, who seems to think that there is a deficit. After some explanation the report is adopted, and we re-elect Dr. Mackay.

New Fellows.

Dr. Morrison, Secretary to the Board of Examiners, next introduces for degrees those who have been admitted by the 'Old' Fellows to the charmed circle at their meeting in the earlier part of the day. Forty-six from the branches and four direct to the Secretary have been recommended for the ordinary degree, while three receive the degree of Honorary Fellow, namely, the Right Honourable Sir Henry Campbell Bannerman, M.P.; Mr. John Ross, ex-Chairman of Dunfermline School Board; and Mr. C. S. Parker, ex-M.P. for Perth. Mr. Ross, on a hint from the Secretary, returns thanks in a very few words.

Deputation.

Mr. J. F. Blacker, Brighton, and Mr. S. Hicks, London, in a few sentences convey the greetings of the N.U.T. Mr. Blacker, in the course of his remarks, shows us how tenure of office is sometimes secured in the south, while Mr. Hicks counsels the older members of the Institute to do all they can to assist the younger men.

With cordial unanimity we agree to accept the invitation of the Stirlingshire Branch to hold our Annual Congress in Stirling.

Afternoon Sederunt.

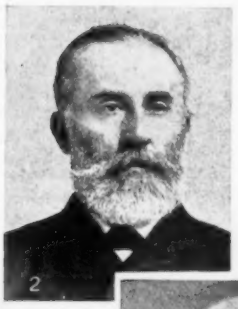
After a short interval the afternoon's sederunt is begun by consideration of the minutes of the General Committee of Management. This disposed of, an animated discussion takes place around the Scheme of District Representation, with the result that we reject, on the motion of Mr. Lee, the Committee's finding on the subject. The only important vote of the day's proceedings is taken now. On the motion of Mr. Arniel, Glasgow, we agree to *provincial* rather than district representation.

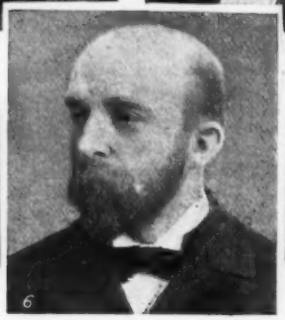
Superannuation.

Under the guidance of Mr. Blackstock we discuss the question of Superannuation, and, while regretting that during the last year we have been simply marking time, we agree to put forth all our efforts to secure success. By the formation of Provincial Sub-Committees, by pressure on M.P.s, and by Congress, we resolve to leave no stone unturned so far at least as *we* are concerned. No longer can we rest satisfied 'with sugary words.'

Higher Education.

On the subject of Higher Education, Dr. Mackay presents his report and moves a resolution to the effect that we disapprove of the changes made in the mode of determining grants recently introduced by the Science and Art Department. Dr. Ross, the convener of the Committee on Evening Continuation Schools, seconds and we approve.





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1896-97.

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2. JOHN LAURENCE, Secretary.
3. HUGH CAMPBELL, LL.D., President-nominate.
4. JOHN DUNLOP, F.E.I.S., Ex-President.
5. JAMES SMITH, LL.D., Hon. Secretary.
6. JOHN ADAMS, M.A., B.Sc., President.
7. ALEX. MACKAY, LL.D., Treasurer.

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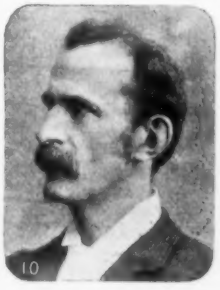
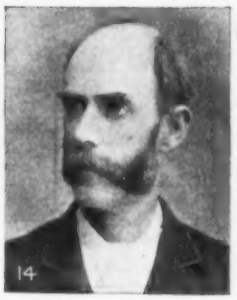
8. JOHN R. JACK, Aberdeen.
9. THOMAS LINDSAY, Glasgow.
10. WILLIAM BLACKSTOCK, Kirkcaldy.
11. JAMES PATERSON, Edinburgh.
12. R. B. STEPHEN, Forres.
13. GEO. A. INNES, Kilmarnock.

VICE-PRESIDENTS-NOMINATE.

14. JOHN M'KENZIE, Aberdeen.
15. J. INGRAM, Wishaw.





Overtures.

An overture from the Ayrshire Branch to the effect that in the interests of education in Scotland it is very desirable that the various grants for educational purposes should be combined, and one from Stirlingshire declaring dissatisfaction with the present system of pupil teachers' examination are adopted without discussion. With the election of the General Committee of Management, the appointment of Auditors—it is agreed to dispense with the paid Auditor, a retrogade step surely—and the report and election of the Board of Examiners, we bring the business meeting of 1897 to a close at 3.30. The meeting in the afternoon is one of the most interesting we have been present at, while at the same time it is the most largely attended. There can be little doubt that the Institute's work is growing in importance.

EDUCATION ABROAD.

BY E. E. FOURNIER D'ALBE, B.SC., A.R.C.S.

A THOUGHTFUL and suggestive article on the relations between professors and students in India appears in the *Educational Review* of Madras. For some reason or other a great change has taken place in these relations during these latter years.

> 'The present generation of native youth in our colleges hear with vain longing of the close intimacy to which their predecessors were admitted by Messrs. Porter and Thomson, and of the genuine solicitude with which their whole lives were watched by their masters. With sighs they listen to stories of how the first teachers welcomed their boys at all times of the day, and forgot to appoint ugly butlers to snarl at visitors, how these lucky boys would be encouraged by them to open their hearts without reserve and without fear of offending some nice rule of propriety, how they would be listened to with unfeigned and lively interest while recounting their domestic difficulties or explaining national peculiarities, how they even used to rouse their masters from their beds on Deepavali morning with the noise of China crackers, and how occasionally they could venture to ask without fear of rebuff for a cup of milk and a few plantain fruits to eat.'

* * * * * *

ALL this is past now, and even the social gatherings recently introduced into college life are unable to bring back the former cordial understanding between English professors and Indian students.

> 'One cause usually given by professors is the great numbers of pupils now receiving instruction in college classes. They complain that it is impossible for them to know everyone individually, and that a full curriculum and a barbarous system of dictating notes leave them no time to think of moral influence, easy conversation, or free commerce. But the real cause of this growing estrangement must be sought elsewhere. This estrangement is but a part of the wider estrangement between the European and the native communities in general. And the causes of the one are likewise the causes of the other.'

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TWENTY-FIVE years ago the political situation was totally different. There was little talk of birthright and privileges. Local self-government was unknown. The National Congress was undreamt of. The Anglo-Indian official was earnestly endeavouring to raise and instruct the conquered people.

> 'The typical Anglo-Indian, on the other hand, of the present day, thinks that we have more education and more self-government than we ever had before or than is good for us to have. He accuses us of ingratitude and even of sedition. He occasionally calls us a nation of liars and intriguers. He considers 50 rupees a month a sufficient salary for a respectable native with a large family of dependants to support, while 350 rupees will scarcely enable an English bachelor to live in comfort in this wretched country. He finds it hard to forget that he is the conqueror of the land, and cannot bear to hear of political equality.'

* * * * * *

THE remedy, according to the writer, is to be sought in the free and unfettered interchange of ideas on political and religious subjects. Within the precincts of a college in which the pursuit of knowledge stifles all display of violent feeling, professors and scholars, accustomed to the examination of questions from all points of view in the unprejudiced search after truth, ought to be able to make their discussions of real educative value. The intellectual life of the awakening East cannot be crippled and confined, any more than the growing mind of a child. But, like the child, it can be directed into the proper paths by wise and sympathetic treatment.

* * * * * *

THE 'Psycho-Physical Law' is discussed at some length in No. 36 of the *Allgemeine Deutsche Lehrerzeitung*. The treatment is, however, not characterised by that accuracy and profundity which one is accustomed to expect from German psychologists. The 'law' was discovered by E. H. Weber in 1851, and afterwards tested and mathematically formulated by Fechner. It maintains that the stronger the stimulus, the greater must be the variation of its intensity in order to produce a perceptible difference of sense impression. If the hand is supporting a weight of 1 lb., it takes an additional $\frac{1}{30}$ lb. to produce a sensible difference of weight. If it supports 3 lbs, another full pound must be added, and so on. Gauged on this 'minimum perceptible' principle—the only trustworthy principle in psycho-physics—the sensations will increase in the proportion of 1 : 2 : 3 : 4 if the stimuli increase in the proportion 10 : 100 : 1,000 : 10,000. Or mathematically, the sensations correspond to the logarithms of the stimuli.

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THIS law is only true within the ordinary range of sensations, and does not apply to very feeble or very powerful stimuli. It has been verified in sensations of light and sound. To say that the pitches of high notes can be determined with much greater accuracy than is indicated by Weber's law is no valid criticism, since the law deals with intensity and not with time of swing. To maintain, on the other hand, that the whole educational fabric must be reconstructed in accordance with the applications of this law is hasty and premature. The fact that 100 strokes of the cane form exactly double the punishment meted out in 10 strokes of the same instrument is hardly likely to be adopted as the foundation of a philosophy of corporal chastisement, nor is a teacher likely to speak in a voice 100 times louder than usual to enhance its impressiveness threefold. But there is no doubt that the young science of psycho-physics is destined to exert a very practical and far-reaching influence upon educational methods. The laws of mental fatigue have already done much to modify the distribution of lessons and school hours.

* * * * * *

AT the Danish Teachers' Congress at Silkeborg, in Jutland, Herr Madsen delivered a stirring address on the relations between the elementary schools and the universities. He strongly criticised the disproportion between the sums spent on the universities and those spent on the national schools. The former are endowed by the State to the extent of 300,000 croner per annum. If the national schools with their 300,000 pupils were to be endowed in the same proportion, the annual subvention would amount to 15,000,000 croner. Half this amount would realise all the aspirations of the friends of the people's schools. The address was received with great enthusiasm.

* * * * * *

THE Berlin Provinzial Schulkollegium recently fined a teacher 250 marks or 25 days for giving private lessons to Polish children in the Polish language. The teacher intends to appeal to the higher court. The case is almost inconceivable according to our notions of liberty. In these Isles, the value of fostering and preserving local traditions and ancient national languages is being increasingly recognised. In Wales and Ireland these languages are taught in a large number of national schools, with the happiest results as regards general mental training and proficiency in the English language itself. We have found out that separatism thrives under persecution, and the vitality of the Polish schools in Posen and in Berlin itself is a living proof of this.

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THE May number of the *Australasian Schoolmaster* contains a full account of the Twelfth Annual Conference of the

State School Teachers' Union of Victoria. It was held in the Melbourne Town Hall and the Athenæum Hall on April 21, 22, and 23, under the presidency of the Minister of Lands and Customs, Acting Premier *pro tem.* The Minister, in his opening address, expressed the full and complete sympathy of the Government with so valuable a meeting as that of the Teachers' Union, the importance of whose work could not be over-estimated. In a democratic community it was necessary to maintain a high standard of intelligence, and this could only be done by having teachers of a high and efficient class. Hence the value of the new Education Act.

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THE Italian University troubles are not yet at an end. When Sgr. Gianturco, the Minister of Education, visited the University of Rome, he was attacked by a crowd of some 150 students of socialist tendencies, and had to fly for his life. It is probable that considerable changes will be made in the regulation of Italian Universities. They are largely attended, but the fact that degrees may be obtained without examination, provided the student shows good behaviour and has attended 80 per cent. of the prescribed lectures, tells against the standard of qualification and the value of the degrees. There is no doubt that splendid work is done at the Italian Universities, especially in science, but something must be radically wrong about the system.

ANNUAL CONGRESS OF THE 'FÉDÉRATION GÉNÉRALE DES INSTITUTEURS BELGES.'

BY C. J. ADDISCOTT.
President of the National Union of Teachers.

THE month of September brings us once more into contact with matters educational in Belgium. The first Sunday in this month is the great field day of the Belgian teachers, for does it not witness the opening ceremonies of the Annual Congrès of the Fédération Générale des Instituteurs Belges? 'Come out, 'tis now September,' is not sung in words but in deeds, for some 1,800 teachers of all sorts and conditions are met together to make a grand demonstration in the capital of the kingdom. Brussels is *en fête;* its international exhibition, its Congo show, its Olympia, its theatres, its decorated and illuminated streets, and its thousand and one attractions have drawn together its pleasure-loving people. The Belgian teacher is *en vacance,* and if to these allurements there be added the privilege of reduced fares on train and tram, special coupons, free or at reduced price for special attractions, a grand reception and *raout* and ball in the fine old Hôtel de Ville, a chance of some fine speeches from the 'grand old man' of the Federation, M. Van den Dungen, its president of 26 years standing, and of meeting old friends and acquaintances; then surely there is enough to draw from their retirement the most rural of rurals. For four days the teachers invade the capital and are everywhere *en évidence.* Last year at Liège we had a grand conference, at Brussels we have a grand demonstration. In the PRACTICAL TEACHER of December last I gave an account of the Educational position from the teachers' point of view. I propose on this occasion simply to bring up to date a few of the questions previously discussed. The part of the programme of the Conference of most interest to an English teacher was that devoted to the subject of the 'Conséquences de l'application de la loi scolaire de 1895.' It must here be explained that the deliberations of the Congress are based upon the reports sent up from the Teachers' Associations. The Associations or Circles in each of the nine provinces discuss during the year a set of subjects proposed to them by the Executive of the Federation. A general meeting of the teachers of the whole province is held. The results of this meeting are embodied in reports which are in reality a series of resolutions. I can best follow up my last year's report by an examination of these resolutions.

The province of Brabant leads off with the bold and comprehensive demand—

'Organisation de l'enseignement primaire par l'État—Enseignement primaire gratuit pour les enfants.' E. Flanders supports in modified terms—'L'instituteur, fonctionnaire de l'État et l'enseignement service de l'État—L'État réglemente tout ce qui concerne les écoles Froebel, les écoles primaires et les écoles d'adultes, d'après des règles fixes.' 'L'enseignement gratuit et obligatoire.' What is behind these resolutions will be plain to those who studied my report of last year; it is the eternal religious question. Between the religious parties—or one might say, the political parties, for practically in educational matters this means the same thing—the teacher is in a tight place' and he sees his deliverance only in a state system pure and simple, and small blame to him.

It will be remembered that by the law of 1884 the Communes received what might be termed 'local option' in the matter of religious teaching and the maintenance of Communal schools. By the law of 1879 the priest had been shut out of these schools, with the result that the Church had built, maintained and managed their own; their growth had been enormous, and the question was not—to express it in English equivalents—that the Board Schools were shutting up the Denominational Schools but that the Denominational Schools were shutting up the Board Schools, for did not the law give to a Commune the right to accept the religious teaching given in the Denominational or Confessional School, not to accept it in the Communal School, but in the Confessional School itself; in other words, to take over or 'adopt' the Confessional School. The Belgian ratepayer took the hint, shut up his Communal School and his pocket at the same time and thus created an army of teachers who became teachers *en disponibilité*—teachers unattached. They were dismissed from their schools, but their irresponsibility was recognised. Had any such teacher completed 25 years of service he carried with him in his retirement, his full salary, and for every year less than 25 he suffered a reduction, losing also his allowance for a house and his prospective increases of salary. Since 1884 over 1,800 of these teachers have found themselves with their occupation gone. In the triennial report of the Belgian Education Department we have the number of these for each year in each province. Thus, even down to 1891–3 Brabant saw 179 of its Communal school teachers dismissed, a small proportion through breakdown, the rest as a result of the working of the 1884 Act; Hainault 162; East and West Flanders 159—the total for these three years reaching 796. In the beginning of the movement, the three years ending December 1887, over 800 Communal schools were suppressed, and in those that remained there was a reduction in the teaching staff of about 500 teachers. These teachers are constantly seeking re-admission into either Communal or adopted schools as vacancies occur, but success is difficult. I saw a reply from a priest to a candidate, in which the application was declined on the ground that the teacher was already in receipt of state pay; why, therefore, did he seek to come into the Confessional school. The prejudice sticks, and the teacher suffers. Another case came to my knowledge of an experienced teacher being turned adrift with his mother and his wife and family—with a subsidy which was altogether too small to make living upon it possible.

The President in his speech at the dinner gave a striking example. The Minister of Public Instruction visited Dieppe to enjoy his annual rest. His baggage was at the Dieppe station in charge of a porter. This porter had been a teacher, discharged by the law which bore the signature of this same minister.

Year after year the Congrès has emphasized the need of help to these teachers, but without success. Every province takes care to include among its recommendations the withdrawal from the Commune of the right to place the teacher *en disponibilité*, by suppressing his office. The adoption of private and Confessional schools is saving the country 6½ millions a year; it seems a fair claim that some of this should go to ameliorate the fate of the sufferers; but nothing is done, and, I fear, nothing will be done. A few may live to see a change in Government policy, and may again come to their own; but at present this prospect seems a very long way off; it is a promised land which few, if any, will reach—they will die in the wilderness. Intimately connected with this grievance is another, upon which the Belgian teachers feel keenly. The conditions upon which a school could be adopted by a Commune and recognised by the Government were duly set

out. They included inspection, free admission of poor children, a conscience clause and the provision of a class in the school, or the provision of another school in cases in which at least 20 parents of a religion other than that of the adopted school—or of no religion at all—made the claim for separate teaching, but no condition was laid down requiring that the teacher should be certificated. The 'unqualified teachers,' therefore, is not a grievance peculiar to England, although with us they are confined to one sex and are found in all classes of schools, while in Belgium they are of both sexes but are not found in the Communal schools—an important difference.

Arising out of this is another demand, which appears in nearly every provincial report, viz., the payment for giving the religious instruction. Religious instruction was, by the law of 1895, made compulsory, to be given by or under the supervision of the '*Chef de culte*,' that is, in this case, by the priest, but he might delegate it to the teacher who had the right to accept or refuse the responsibility. This looked well on paper, but one easily sees how it would work out. Refusal meant the introduction of 'other persons not attached to the school,' who might be paid while no remuneration rewarded the services either of priest or teacher. The teacher lives in the midst of a Catholic community, the children go to school, the mothers to confession, and the position of the teacher who declines to give religious instruction can be easily guessed. In its results the teacher gives the religious instruction, and he now naturally asks to be paid for it. I am afraid he will have some difficulty in getting this claim allowed.

Other resolutions sent up from the provinces deal largely with the question of salaries. The minimum salary is regulated by the State and set out in the law of 1884. The demands of the teachers are :—(1) The suppression of the 5th Category. (2) An increase in each of the other Categories. (3) The quatrennial increases to be of larger amount, to be certain, to be made retrospective so that past services might not go unrewarded. (4) The abolition of the rule by which one-fifth of the salary of a teacher who is ill is deducted to aid the salary of the supply-teacher. (5) The regular monthly payment of all saiaries by the Communal authorities. In explanation I give the official scale, in francs.

	Male		Female	
	Head Teachers.	Class Teachers.	Head Teachers.	Class Teachers.
5th Category.—Communes of 1,500 inhabitants and less	1,200	1,200	1,000	1,000
4th Category.—Communes of 1,501 to 10,000 inhabitants	1,400	1,300	1,100	1,100
3rd Category.—Communes of 10,001 to 40,000 inhabitants	1,600	1,400	1,200	1,100
2nd Category.—Communes of 40,001 to 100,000 inhabitants	1,800	1,600	1,300	1,200
1st Category.—Communes of more than 100,000 inhabitants	2,400	2,200	1,400	1,200

It must be understood that this is a minimum, that while no Commune can pay less many pay more ; the large towns considerably more. In one of the divisions of Brussels one of my friends receives as salary £160, plus a house, light, etc., valued at £80, and for supervision of winter evening classes for adults £20 more, and the prospect of a retiring pension equal to two-thirds of his salary.

In all cases one must add to the minimum scale an house or an allowance for a house, and a rise of £4 every four years to a maximum of £24, and the prospective pension, together with the advantage of a widow and orphan fund to which the teachers subscribe. Upon the first of the five points I quote the conclusion sent up by Lunbourg :—'L'existence de la 5th Catégorie est inique et peut même être considerée comme une criante injustice. Elle accorde aux instituteurs un traitement insuffisant et les place loin au-dessous de leurs confrères des Communes of 1,500 inhabitants et au-delà.' Upon the second, the only definite recommendation made is that the salary shall increase with the years of service. Upon the third I quote the conclusion of E. Flanders : 'Les traitements s'appuient sur une base fausse. Les anciens instituteurs sont sacrifiés, leurs années antérieures sont perdues pour l'augmentation. La différence entre les traitements des chefs et des sous-instituteurs est trop grande.' The fourth is a claim which is being gradually recognised ; three provinces—Hainaut, Liège, and Brabant—do not make this deduction from a salary already small at a time when the demands made upon it are greater.

Such are the chief claims of the teachers in so far as their position depends upon the law of 1895. The remaining points in these reports are :—(1) The regulation of the size of the classes, none to exceed a certain fixed maximum ; and already, I might say, that the average size of a class in a Belgium school is much smaller than in English schools. (2) The writing out and making up of the lists of results of individual scholars involves too much time and labour. (3) The curriculum is overcharged with subjects. (4) A teacher might receive an adverse report, or be otherwise injured without having had an opportunity of vindicating himself. (5) The revision of the law on pensions and the increase of the funds set aside for widows and orphans.

I have now put my readers in entire possession of the needs of the Belgian teacher as he himself presents them. Of course they are presented in various moods—timidly or boldly, hopefully or despondently. Brabant puts its claims so modestly that in reading them one has an idea that things are not so bad after all ; while Limbourg goes in for a general Jeremiad. It may be of interest to quote a part of its report :—'Aussi les griefs suivant restent encore debout : (1) La fréquentation irrégulière des enfants. (2) La trop grande population de l'école. (3) Le programme beaucoup trop étendu. (4) Le grand nombre de branches d'enseignement. (5) L'indifférence de l'authorité locale eu fait d'education et d'enseignement. La loi lui reconnaît tous les droits mais lui laisse ignorer les devoirs qui en découlent. (6) La négligence et l'insouciance de maints parents. (7) La lutte contre l'enseignement public. (8) La loi ne reconnaît à l'instituteur aucun pouvoir, aucune liberté ; elle les place entre les mains de ceux qui n'en font ou n'en savent faire usage que lorsqu'il s'agit d'atteindre l'instituteur dans son autorité ou dans sa situation matérielle. (9) La loi a aggravé la situation morale de l'instituteur. Il n'est plus libre, il ne jouit plus que de peu d'autorité, il est considéré comme l'humble serviteur des autorités locales et comme l'esclave des parents et des enfants.'

Are not these but the distant echoes of voices that have been crying in our own educational wilderness anytime during the last quarter of a century ? *Il va sans dire* that the recommendation I have detailed were adopted almost without discussion, for they were the expressions of the personal needs of all the '*Congressites*' present. Upon other questions there was more controversy. These were the creation and organisation of Froebel schools, evening adult classes, professional or trade schools, and domestic economy schools for girls. The need of these, the position of each in the general system, the curriculum, the diploma and general position of the teachers, salaries and special payments were discussed.

Upon the question of technical and trade schools Belgium is making rapid advances. Forty of these schools well equipped and staffed and attended by some two thousand pupils, are now in existence ; and here and there in the Exposition one saw evidence of the excellent work done in them.

The teachers of Belgium are in thorough earnest in promoting in every possible way the establishment of these various classes of schools. The impression left upon one is that the Government authorities have behind them, in the teachers of their Communinal schools, a body of enthusiasts upon whom they can rely in any forward movement towards a national system of education. The Echevin of public instruction spoke in warm praise of the teachers' devotion, and of the righteousness of their claims. The teachers, therefore, do not stand alone. In the large towns, at least—notably in Brussels and Liège—public opinion is with them, and they are doing their best to educate that public opinion by these conferences, by the dissemination of literature, by using the public press to a greater extent, and by taking advantage of every means open to them. In this we wish them all success. A change in public policy may come at any time ; it is a 'simple tour de majorité.' The teachers may have to wait long for their innings, but when they do get it, they will score heavily.

OUR CLASS ROOM AIDS

NOTES OF A LESSON ON WHEAT, OATS, AND BARLEY.

BY WILLIAM DONE, B.A.,

Head Master of the Brighton Pupil Teachers' School.

SEE SUPPLEMENT PRESENTED WITH THIS NUMBER.

HEADS.	MATTER AND METHOD.
I.—Wheat, Oats, and Barley are Cereals belonging to the Order of Grasses.	As it is so easy to obtain specimens of the three cereals here selected, this should be done and used to supplement the Lesson Sheet. Take also previously two or three broad beans and some grains of wheat and allow them to germinate. In the former case the primary root or radicle elongates, in the latter case three or four little bud-like processes develop from it and grow down as tiny rootlets.
(*a*) *The Root.*	
(*b*) *The Leaves.*	We notice the leaves are long and narrow —*linear*—the *veins are parallel.* Contrast with the venation in the leaf of a Dicotyledon.
(*c*) *The Stalk.*	The stalks, too, in our three plants are cylindrical and hollow except at the joints—probaby some of the children have made mouth-organs from wheat stalks.
	By showing other specimens and grasses and comparing them we shall be able to classify our examples:—Wheat, oats, and barley belong to the order of grasses, and are *Monocotyledons.*
(*d*) *The Flower.*	The flowers are arranged in spikelets on a central axis or *rachis.* The spikelets are inclosed at the base by, usually, two empty *bracts* or *glumes.* These are followed by one or more flowering glumes. We see in Fig. 11 the midrib of one of the glumes prolonged into a bristle-like process—the *awn.* This explains the bearded appearance of the plant.
(*e*) *The Seed.*	Let the children examine some grains of wheat. Show also some *bran*—the outer yellowish coat of the grain. Take some flour of wheat in a muslin bag and hold it under the tap. Much of it will be washed away, but the remainder will be sticky.
	The liquid with which we washed the flour will contain *starch.* Test it with a few drops of iodine solution.
	The sticky substance left is *gluten.* We can understand, therefore, how useful wheat is to us. Gluten is a nitrogenous food, and starch is a carbohydrate.
	Figs. 18, 19, 20 show us in a highly magnified condition the different forms the starch granules take. It is possible to find out where certain starch has come from by examining in this way the form and size of the granules. Good wheat flour contains about 10 per cent. of gluten.
	Examine some grains of barley. Let class taste some and also some *malt.* See Fig. 14. Malt consists of barley made to germinate by warmth and moisture and then dried in a kiln.
	This gives rise to a special ferment—*diastase*—which has the power of turning starch into sugar. Notice its sweet taste. Show some *pearl barley.* This is the grain without the skin, and polished.
	The oats examined will probably be those styled potato oats.
	The meal of this grain is remarkable for its richness in gluten, and for containing more fatty matter than any other of the cereals.
	Oatmeal is the grain deprived of its husk and ground.
	Groats is the grain without the husk.
II.—Where grown.	The geographical limits of wheat in Europe are from 30° to 60° north latitude. Thus we see it is especially a plant of the temperate zone. In the tropics wheat is cultivated only in the mountainous districts, where the land is sufficiently elevated to be of the proper temperature. We in England have to import about three times as much wheat as we can grow. This is obtained chiefly from the United States and Russia; in smaller quantities also from India, Austria-Hungary, and Roumania.
(*a*) *Wheat.*	There are many varieties of wheat, but the most important are the Spring and Autumn wheat. Spring wheat is generally sown in April, and reaped in the summer of the same year. The plant is less thick and strong, and it is *bearded* (Fig. 2). The grain, too, is smaller.
	Autumn wheat is sown in September or October for the harvest of the following year.
(*b*) *Barley.*	Barley is not so much affected by changes of temperature. It will grow as far as 70° north latitude and 42° south latitude. Imports of barley come from Russia, Turkey, Roumania, France, and Germany. Two crops are grown in warm countries; one, the winter barley, sown in Autumn and reaped in Spring, and the other sown in Spring and reaped in Autumn.
(*c*) *Oats.*	Oats are the most hardy of all the wheat grains. From 70° north latitude down to 25° south they will grow, but they flourish best in the strictly temperate zone. We all know that oats are the favourite grain of Scotland. The same is true of Russia and Germany. Our chief imports come from Russia, Germany, and British North America.
III.—Uses of the Straw.	Many of the uses of the straw may be elicited, notably the making of straw plait.
	In Fig. 3 we have an enlarged representation of a length between the knots. In Figs. 7 and 8 we see how this is split. Straw must be selected which is not brittle, and then it must also be bleached. This is done by means of sulphurous acid fumes.
	Show different kinds of straw plait. Novelties in this are much sought after by dealers. In England the district round Luton is where straw-plaiting is mostly carried on. Wheat grown in Tuscany is very suitable for the purpose, whence we get the celebrated Leghorn straw.

Heads.	Matter and Method.
IV.—Corn-mills.	Refer briefly to the mills in which the corn is ground. Either they are worked by steam or wind power, but the principle embodied in the two circular-shaped stones in Fig. 21 remains the same. The lower stone is stationary, the upper one revolves. The corn-mill, like the potter's wheel, is of such ancient date that it is beyond all recorded history.

CLASS LESSONS IN DOMESTIC ECONOMY.

BY ETHEL R. LUSH.

Author of 'Chats with Children on Domestic Economy,' Organising Mistress to the Ipswich School Board, Head Mistress of the Ipswich Higher Grade School.

Lesson XIII.

STANDARD IV.

CLASSIFICATION OF FOOD: GREEN VEGETABLES AND FRUITS.

[*Apparatus required.*—Specimens or pictures of the different fruits and vegetables.]

THIS array of vegetables and fruits, which makes the class-room look like a greengrocer's shop, will indicate to you the subject of our lesson. We shall learn what an important part these articles of food play in our diet, and how necessary they are to health. It is interesting to note, not only the variety of vegetables which we cultivate for food, but how the parts eaten differ in the various plants. Thus it is the root of one, as in the carrot, turnip, and parsnip; the stem of another, as the onion and potato; the leaves of a third, as in the cabbage; the fruit of a fourth, as the vegetable marrow.

In every part of England we find market gardens, yet the supply does not equal the demand, and immense quantities are regularly imported from the Channel Islands, France, and Belgium.

Though green vegetables contain a certain amount of starch, it is not so much on this account that we value them, as for the mineral salts they contain. In an early lesson you learnt that food of a mineral nature is necessary to build up bones and teeth, to purify and to enter into the composition of the blood, and to form the digestive juices. Green vegetables contain these essential salts in such proportion, that when they are absent from a diet, and no substitute provided, the result is seen in an impoverished condition of the blood, weakened digestion, and consequent diseases of the skin. That terrible disease—scurvy—which used to be such a scourge among sailors on long voyages, is often caused by a deficient supply of mineral salts.

Now let us take the vegetables, one at a time, and consider them.

The potato, being the most general, must come first. As you recently heard, one-fourth of the potato consists of starch, the other three-fourths being principally water. In Ireland it forms almost the staple food; it is eaten with buttermilk, which supplies the flesh-forming substances the potato lacks. New potatoes are not nearly so digestible as old potatoes, and, when cooked, are solid and waxy, instead of being floury.

Carrots, *parsnips*, and *turnips* are roots, and contain a fair amount of nutriment in the form of starch and sugar. They are largely used in stews and soups.

Turnips are very watery, but more digestible than some vegetables. Swedes and mangold-wurzels are used by the farmer to feed his sheep in winter.

The beet-root is of a fleshy nature, not unlike the carrot, but is of a deep red colour. It is boiled, used as a garnish, and eaten as salad. It is valuable for the sugar it contains.

The *Cabbage family*, including cauliflowers, broccoli, Brussels sprouts, etc., are chiefly composed of cellulose and water, but are valuable for their mineral salts.

Onions are among the most valuable of our vegetables. The Spanish onion is larger and milder in flavour than the English variety, and forms a nourishing and digestible article of food. English onions are used chiefly for flavouring and pickling. The characteristic smell and taste of onions is due to a pungent oil.

All the vegetables yet named are cooked before being eaten, if we except the onion, which is occasionally eaten raw; but there are others which are generally eaten raw.

Celery is a good instance of this class. The blanched leaf-stalks form a popular and nutritious article of diet. Sometimes the outer stalks are boiled, as a vegetable, and served like cauliflower, with melted butter, and the tender tops are put into soups.

Other vegetables, known as *salads*, are invariably eaten raw. Examples of these are found in watercress, lettuce, endive, radish, and cucumber.

With respect to salads, let me impress upon you the necessity for carefully washing all vegetables that are to be eaten raw. Not unfrequently the leaves contain the eggs of parasitic worms, which, if introduced into the human body, develop, and produce dangerous illnesses. It is wise to wash salads in water containing salt.

Having mentioned, in passing, the various herbs, such as parsley, mint, thyme, sage, which are used for flavouring purposes, we shall turn our attention to the more tempting fruits. At the fruiterers we find both English and foreign fruits, for the latter can be imported at so little cost that they are within the reach of all.

Of English fruits, the chief are the apple, pear, plum, cherry, apricot, peach, red and black currant, gooseberry, raspberry, strawberry, and blackberry.

The apple is one of the most wholesome of fruits. It is eaten raw, and is, besides, cooked in many ways. Strange as it may seem to you, it is not a native of England, but was introduced from the East many hundreds of years ago. From the apples grown in the extensive orchards of Hereford, Gloucester, Somerset, and Devon, a popular drink called cider is made. Very fine apples are imported from Tasmania and North America.

The pear is not so useful a fruit as the apple, but has a very delicious flavour, and is very wholesome stewed. Like the apple it is not a native of England. Perry, a drink resembling cider, is made from the juice of the pear.

Cherries, too, were introduced into England from abroad. They are most generally eaten raw, but may be cooked in pies and puddings.

Plums are eaten both raw and cooked. Like all stone fruits they are likely to cause disorders of the digestive apparatus if eaten unripe or too ripe. They are most wholesome when cooked. There are many different varieties of the plum, the greengage being perhaps the most popular. The damson is smaller than most varieties; it takes its name from the fact that it originally came from Damascus.

Peaches and *apricots* are very delicious stone fruits, but unfortunately they are too expensive to be within the reach of any but the well-to-do.

Strawberries and *raspberries* rank high because of their delicate flavour. The former is usually eaten raw, or made into jam. It loses much of its flavour in cooking. The latter is quite as popular cooked as raw.

Blackberries are not cultivated, but are gathered from wayside hedges. They are eaten either raw or cooked, and form very good jam.

Currants are of three kinds—black, white, and red. They are more often cooked than eaten raw.

Black currants are made into jam and black currant vinegar, both of which are useful in curing colds and sore throats.

Red currants, too, are made into jam, frequently mixed with raspberries.

Gooseberries are larger than currants, but have the same juicy nature. They are cooked when green, and eaten raw when ripe.

Of foreign fruits the banana, pineapple, melon, orange, lemon, grape, date, prune, and fig are the chief.

The banana possesses considerable nourishing power, and in the tropical countries where it is grown it forms an important article of diet.

The date, too, is of very great importance, as is shown by the fact that it is called the 'Bread of the Desert.'

Of *oranges* I need say little. We import them in immense quantities from Spain, Malta, Sicily, Brazil, and the West Indies, and they are so cheap that even the poorest can obtain them. They are gathered green, packed in boxes, and sent to England, ripening on the way into the yellow fruit we know so well.

The lemon and *citron* come to us from Madeira. The former is extensively used as a flavouring agent. Indeed, it is difficult to say what we should do without it.

Grapes are imported from the vineyards of Southern Europe, and form a very wholesome and refreshing addition to our articles of diet. They are largely used for making wines.

Dried fruits include raisins, currants, figs, and prunes.

Raisins and currants are dried grapes. Of the former there are the three varieties, muscatels, sultanas, and Valencias. Currants come from Corinth, and are a small kind of grape grown in Greece. Muscatels are eaten with almonds, but the others are used in making cakes and puddings.

Figs are imported from the countries in the South of Europe.

Prunes are dried plums. Frequently the stone is taken out during the process of preparation. They may be eaten raw or cooked.

The *value of fruit* as an article of diet lies, like vegetables, in the mineral salts it contains. It also has a very large proportion of sugar, and cellulose or woody fibre. The latter, though of no nutritive value, is useful in promoting the action of the intestines.

Fruit is generally eaten as a stimulating addition to food, rather than as a food itself, and in cases of illness it often proves valuable in creating an appetite.

Nuts, of which the chief are the walnut, almond, Brazil nut, cocoa-nut, hazel-nut, and chestnut, contain a large proportion of oil. This provides a certain amount of nutriment, but at the same time renders them very difficult of digestion. The *chestnut* contains very little oil, but a large amount of starch. If you boil a chestnut, its floury appearance will remind you forcibly of a boiled potato. Chestnuts are very indigestible when raw, but when cooked they are easily digested and nutritious.

SUMMARY.

Green Vegetables and Fruits.

Vegetables are imported from the Channel Islands, France, and Belgium to supplement those grown in England.

Green vegetables are valuable for the mineral salts they contain.

The principal vegetables are the potato, carrot, parsnip, turnip, beet-root, cabbage, cauliflower, onion, celery.

Salads include lettuce, endive, cress, watercress.

English Fruits.—Apple, pear, plum, peach, apricot, cherry, currant, gooseberry, raspberry, strawberry, blackberry.

Foreign Fruits.—Banana, pineapple, melon, orange, lemon, grape, date, prune, fig.

Fruits are used as food-adjuncts. They stimulate and create an appetite, and are valuable for the mineral salts they contain.

Nuts are oily, fairly nutritious, but indigestible. The chestnut is of a starchy nature.

AN ENTIRELY NEW OBJECT-LESSON SUPPLEMENT, BEAUTIFULLY PRINTED IN COLOURS or TINTS, is, month by month, presented with every issue of the 'PRACTICAL TEACHER.' Will our readers kindly make this known to their professional friends?

PICTURE PROBLEMS IN ARITHMETIC.

BY B. ELDERKIN,

Model School, Westminster Training College.

THE difficulties experienced in getting young children to work problems successfully arise from (*a*) their inability to *read*; (*b*) their lack of imagination; and (*c*) the low development of their reasoning faculties.

These defects may be remedied to a great extent by making all the questions in the stages covered by Standards I. and II. *pictorial* and *oral*. These should be accompanied by brief notes on the blackboard, and later in the school year altogether superseded by the written questions.

For example, let a rough sketch of a *tree* be made on the blackboard by the teacher thus :—

Imagination will soon be called into play, and a knowledge of the laws of numbers developed by clothing the branches with leaves, nuts, oranges, apples, etc. It will be necessary to accompany each numerical statement with figures written as shown.

Make it a practice to commence with very simple exercises which can be worked mentally, and gradually lead up to those which are beyond mental solution only. The principle on which the solution depends should always be mastered before the mental exercises are dropped.

The following are cited as illustrations of the use of the pictures as applied to the first four rules. The ingenuity of the teacher will discover other pictures and their applications :—

1. *As to Addition.*—Let the scholars find the number of nuts on branches 1 and 2 ; 3 and 4 ; 1, 2, 3, 4 ; on the branches on right hand side of tree ; ditto, on left hand side ; on all the tree. The teacher asks the question *orally*, and it may be points out exactly which branches are to be selected. Take the greatest pains in setting out the solution of each sum, as the side notes explanatory of each step will train the reasoning powers, and so prepare the scholars for reading and understanding written question without the aid of the pictures.

2. *As to Subtraction.*—Ask how many nuts on highest branch ?—on lowest ? How many more on highest than on lowest ? How many more on 2nd than on 1st ? 2nd than third ? and so on.

3. *As to combination of Addition and Subtraction.*—Such questions may be given as, 'Which have more apples, and how many more, 1st two branches or 2nd two ?' 'Two lowest on left hand side, or two lowest on right side ?' 'Which side of tree bears most fruit, and how many more apples on one side than the other ?'

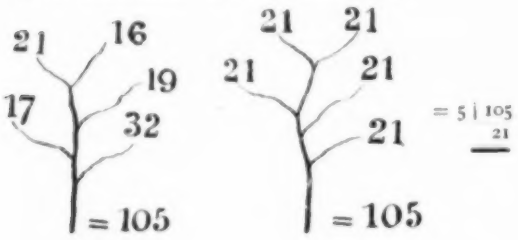
A more difficult form of problem, but a very useful one, is to supply numbers for all branches except one, and to get the pupils to find the number which must be on that branch to produce a given total, *e.g.*, 'Total being 706, and branches containing 13, 14, 17, 19, 28, how many must be on the sixth ?'

4. *As to Multiplication.*—(*a*) Count up totals on each branch (addition), then how many would there be on 2, 5, 17, etc., such trees ?

(*b*) There being 13 on 1st branch, how many on tree if each branch contained the same number. Here the *counting* of the branches will be necessary to obtain a multiplier :

prove result by addition. These examples may be increased almost to any extent.

5. *As to Division.*—Have two trees thus :—



Find total number of oranges on No. 1 = 105.

'If the same number of oranges were equally distributed on tree No. 2, how many would there be on each branch ?' Proof seen in the equality of totals.

Proceed with more advanced examples as required. Combinations of the rules will readily suggest themselves. To vary the form of picture, sketch a chest of drawers, a book case, a railway train, or allow a few of the scholars to hold their slates in front of the class while the teacher chalks a small portion of the question on each slate.

These sketches will take far less time than would be occupied in writing out each question, and the scholars will always know what result they are working for, and the steps to take to reach it.

In the higher standards problems should always be *written*, but diagrams may well be called in to aid in their solution.

Here are hints which will help with those troublesome problems relating to debtors and creditors.

1. *To find loss in the £1.*—Work with easy examples till a rule is found thus :—

Debts £100. Assets £75.

To find loss per £.

Total Debts £100.	=	Assets £75 Loss 25 £100	∴	(?) Find loss per £1.

Loss = £25 out of £100.

∴ Loss per £ = $\frac{25}{100}$ = ¼ of £1 = 5s.

2. *To find a Dividend.*

Let Debts = £150.
„ Assets = £60.

Total Debts £150.	=	Assets £60 Loss 90 £150	(?) What received on each £1.

For Dividend.—Receipts £60 out of total debt of £150.

∴ Receipts on £1 = $\frac{60}{150}$ = 8s. per £1.

3. *To find a Creditor's share* of Dividend or Loss.

Assets £60. Debts = £180. Creditor's debt £15.

How much will he receive or lose ?

Debts £180.	=	Assets £60 Loss 120 £180	∴	(?) Find dividend or loss on £15.

Assets = £60 ÷ £180 = 6s. 8d. in £1.
Loss = £120 ÷ £180 = 13s. 4d. in £1.
= £1 in £1.

∴ Dividend = 6s. 8d. × £15.
∴ Loss = 13s. 4d. × £15.

4. *To find Debt.*—Let Assets be £60.
„ Dividend be 2s. 8d.

What was the debt ?

(?) Total Debt.	=	Total Assets = £60 + Total Loss.

∴

£1 Each pound of Debt.	=	£1 Assets 2s. 8d. Loss 17s. 4d. £1 0s. 0d.

If this statement were repeated enough times to *exhaust* the £60 of assets it would equal debt.

∴ Rule is—

$$\text{Debts} = \frac{\text{Assets}}{\text{Dividend}}.$$

Application to Tax Problems.—Example 1. 'After deducting 4d. in the £1 for taxes, a person's income is £200 ; what was his gross income ?' The disposition of *each* pound of gross income is thus accounted for.

(1)	(2)	(3)	(4)
£ s. d. Tax 4 Net Inc. 19 8 Grs. „ 1 0 0	£ s. d. Tax 4 Net Inc. 19 8 Grs. „ 1 0 0	£ s. d. Tax 4 Net Inc. 19 8 Grs. „ 1 0 0	£ s. d. Tax 4 Net Inc. 19 8 Grs. „ 1 0 0

It is obvious that if I repeat this until I have exhausted his *net* income, which equals £200, I shall know how many £'s he had at first.

∴ Gross Income = £ $\frac{\text{Net Income}}{\text{19s. 8d.}}$.

Example 2. 'A person's net income after deducting 10d. in the £1 for taxes and 5 per cent. on the remainder for cost of collecting was £120, what was the gross income ?'

The disposition of gross income may be thus accounted for :—

Gross Income (?)	=	Total Taxes + Total Expenses + Net Income.

Each pound of gross income may be thus accounted for :—

1. £1	2. £1	3. £1
s. d. Tax - 10 5% on 19/2 11½ Net Income 18 2½ Total £1 0 0	s. d. Tax - 10 5% on 19/2 11½ Net Income 18 2½ £1 0 0	s. d. Tax - 10 5% on 19/2 11½ Net Income 18 2½ £1 0 0

How often will it be necessary to repeat this so as to arrive at the exhaustion of total income ?

∴ Rule, $\frac{\text{Net Income}}{\text{18s. 2½d.}}$ = Gross Income.

Under 'Composition Themes and Moral Training,' a Lesson on THRIFT, by Mr. Elderkin, will appear next month.

NEW PROBLEMS IN ARITHMETIC.

BY T. B. ELLERY, F.R.G.S.

☛ **Excellent practice for the Pupil Teachers' Examination in October, and the Queen's Scholarship Examination in December.**

THIRD SERIES.

STANDARD VII.

Every exercise here given will suggest to the practical teacher many others of the same kind. May I say, too, that the blackboard should be freely used in the solution of these problems.

Some of the exercises may, perhaps, be considered too difficult for the particular Standard in connexion with which they are set, but they are given for the purposes of blackboard lessons and as a preparation for more advanced work.

Each exercise should be written on the board, read by the teacher, and then by the class. Every effort should be made to encourage the children to think, and to this end preliminary mental practice should be given before any one problem is attempted.

A.

1. What sum will amount to £1,684·375 in 3 years 219 days at 2½ per cent. per annum simple interest?

2. A's total income is £480, and B's £290. Income tax being at the rate of 3·3 per cent., by how much does A's net income exceed B's, A not paying on his first £100, and B on his first £160?

3. A draper marked his goods 25 per cent. above cost price. Find his actual profit if he allow a customer 4 per cent. for cash.

4. If 8½ per cent. more is gained by selling a horse for £16 than by selling it for £15, what was the original price?

5. A train runs at the rate of 50 miles an hour for 24 minutes, and then at the rate of 30 miles an hour for 12 minutes. What is the average rate of running per hour?

6. A sells a horse to B, losing 20 per cent. on the sale. B sells it to C for £20, gaining 20 per cent. on the sale. What did A give for the horse?

7. A man makes two investments of equal amounts, one bringing in 2½ per cent. interest and the other 3¼ per cent. His yearly interest being in all £220, find the total sum invested.

8. X walks 88 yards in a minute. Y walks 160 yards in 2 minutes. How far is Y behind when X has walked a mile and a half?

9. A invests money in 3½ per cents. at 104⅞, and B in 3¾ per cents. at 119⅞, brokerage at 2s. 6d. per £100 being charged in each case. Compare the rates of interest they receive for their money.

10. A certain number is multiplied by 1·67, and this product when divided by 5·06 gives a quotient 40·08. Find the number.

11. £5 shares in a company which pays 16 per cent. sell for £17 10s. What percentage does an investor receive for his money?

12. I buy oranges at the rate of five a penny. How many should I sell for sevenpence to gain 40 per cent.?

13. A man sells 100 eggs for 6s. 6d., gaining one-fifth of his outlay. What ought he to have charged for them to gain one-fourth of his outlay?

14. I divide a certain number by 180, and employing short division, use the factors four, five, and nine. The several remainders are two, one, and five. Find the complete remainder.

B.

15. By selling tea at 2s. 4d. a pound a man clears ⅛ of his outlay. What must he charge per pound to gain 33·3 per cent.?

16. A man bought two kinds of tea at 1s. 6d. and 2s. a pound, and mixed them in the proportion of 3 : 7. He sold the mixture in 5-lb. packets at 12s. 4d. a packet. Find his gain per cent.

17. A postage stamp is $\frac{5\frac{3}{4}}{6}$ in. long and $\frac{1\frac{3}{4}}{2\frac{1}{4}}$ in. wide. How many will be required to cover a board 3 ft. 10 in. long and 3 ft. 3 in. wide?

18. Find the surface (in sq. yd., &c.,) of a closed rectangular box, the length being 3 ft. 4 in., the breadth 1 ft. 8 in., and the depth 10 in. And find the cost of painting the whole surface at 2½d. per sq. ft.

19. Which is the cheaper, a piece of cloth ⅝ yd. wide at 4s. a yard or one 2¾ ft. wide at 4s. 7d. a yard? If 11 yards of the former are sufficient for a dress, how much will be required of the latter?

20. A train runs at the rate of 40 miles an hour, and covers a certain distance in 4 hours 45 minutes. How long would another train, which runs 3 miles in the time taken by the former to run 5, take to cover the same distance?

21. A farmer bought 84 sheep for £157 10s. He lost 4, and sold 20 of the others at 7s. 6d. each less than he gave for them. What did he charge for each of the others, the gain on the whole transaction being 10 per cent.?

22. The total number of boys in three schools is 670. The proportion of boys in the first and second schools is as 3 to 4, and in the second and third schools as 5 to 8. How many boys are there in each school?

23. Divide £2 17s. among A, B, and C, so that B may receive half as much again as A, and C ⅘ of B's share.

24. The sum of £11 13s. 4d. is divided among A, B, and C. A's share is to B's as 2 to 3, and B's to C's as 4 to 5. Find the share of each.

25. A wheel is 7·875 ft. in circumference. How many times does it revolve in a minute, the rate of travelling being 9·45 miles in an hour and twelve minutes?

26. A man bought goods to the value of £120. He sold one-third at a gain of 20 per cent. What must he charge for the remainder so as to make a gain of 40 per cent. on the whole transaction?

27. I sell out £4,000 2⅝ per cent. stock at 92½, and invest in the 3½ per cents., increasing my income by £18 6s. 8d. Find price of the 3½ per cents.

28. A man bought 12 houses, for which he paid in all £5,400. He paints and repairs the houses, and then lets each of them for £27 10s. per annum, thereby making 5½ per cent. per annum on his money. What did he spend on painting, repairs, &c.?

C.

29. A and B together can do a piece of work in 2½ days, A and C in 3¼ days, and B and C in 5 days. In what time would they, working together, do one-half of the work?

30. Three men rent a field for 14 guineas. One puts in 16 sheep for 6 months, the second 24 sheep for eight months, and the third 30 sheep for 10 months. What portion of the rent must each pay?

31. If 100 gallons of water weigh 8 cwt. 104 lb., and a cubic foot of water weigh 62·5 lb., how many gallons are there in a tank containing 2,400 cubic feet?

32. What is the annual rent of a house on which, after deducting ⅛, a rate of 3s. 6d. in the £ produces a sum of £12 5s.?

33. Two men bought books, one at the rate of 20 for 1s. and the other at the rate of 30 for 1s. 8d. They sold the books at a penny each, the former's profit on the whole sale being 1s. 8d. more than the latter's. How many did each buy?

34. A and B are to receive 78s. for a piece of work at which A works 10½ days and B 12 days. How should the money be divided, A doing as much in 6 days as B in 8?

35. A can do a piece of work in 12 days. In what time will A, B, and C together do it, if A can do as much in 6 days as B in 9 days, and B as much in 6 days as C in 12 days?

36. What do I gain or lose per cent. by buying apples at 10 for 2d., and selling ⅓ at 3 a penny, ⅓ at 4 a penny, and the rest at 6 a penny?

37. A train which travelled at the rate of 25⅓ miles an hour ran from A to B, two towns 456 miles apart. Another train left A four hours after the first train had started, and reached B 24 minutes later than the first train. Compare their rates of running.

38. A bill of £140 is paid partly in bank notes to the extent of £30, and the remainder in sovereigns, half-sovereigns, and crowns in the proportion of 1 : 2 : 3. Find the amounts paid in sovereigns, half-sovereigns, and crowns.

39. How must I divide my capital of £2,681 10s. in investing it partly in the 2½ per cents. at 96 and the rest in the 2½ per cents. at par so that my income from the two investments may be the same?

40. A cistern holds 600 gallons, and is filled by three pipes in 24 minutes. One pipe discharges three gallons more and the other two gallons less than the third pipe per minute. Find how much flows through each pipe in a minute.

41. A man buys boots at 9s. 6d. a pair. At what price must he sell them a pair so as to gain 25 per cent. and allow the buyer 5 per cent. for cash?

42. A stream flows at the rate of 20 yards a minute. How far will a man swim with the stream in a quarter of an hour, his rate of swimming in still water being 20 yards in a quarter of a minute? And in what time will he swim 1,800 yards up stream?

ANSWERS.

1. £1,562 10s.
2. £181 13s. 4d.
3. 20 per cent.
4. £12.
5. 4⅜ miles.
6. £20 16s. 8d.
7. £8,000.
8. 240 yards.
9. 16 : 15.
10. 121·44.
11. 4½ per cent.
12. 25 oranges.
13. 6s. 9½d.
14. 106.
15. 2s. 8d.
16. 33⅓ per cent.
17. 2,016 stamps.
18. 2 sq. yd. 1⅛ sq. ft.; 3s. 7½d.
19. The former; 10 yards.
20. 7 hr. 55 min.
21. £2 7s. 9d.
22. 150; 200; 320 boys.
23. A, 18s.; B, 27s.; C, 12s.
24. A, £2 13s. 4d.; B, £4; C, £5.
25. 88 times.
26. £120.
27. Par.
28. £600.
29. 1⅔ day.
30. £2 8s.; £4 16s.; £7 10s.
31. 15,000 gallons.
32. £105.
33. 300 books.
34. A, 42s.; B, 36s.
35. 6 days.
36. 25 per cent. gain.
37. 4 : 5.
38. £40; £40; £30.
39. £1,384; £1,297 10s.
40. 1st, 11 gal.; 2nd, 6 gal.; 3rd, 8 gal.
41. 12s. 6d.
42. 1,500 yards; ½ hour.

NEW READING TESTS.

STANDARD III.

Suitable for 'Unseen Tests' in Dictation also.

373.—The vessel cracked and trembled so violently that all expected each minute would be her last, and that with her would disappear the slight remaining chance of escape for those on board. The rushes of ice, however, though continuing from all directions, came on with slackening force, until at last the immediate danger once more passed away.—(H.M.I.'s Test.)

374.—The work of the timber yard was nearly all done by elephants, and it was great fun to watch these enormous beasts push the huge logs along with their tusks to the required place, and then lift them carefully with their trunks on to the pile with the other logs. The drivers, sitting astride their necks, seemed hardly to direct them at all.—(H.M.I.'s Test.)

375.—The diver can be pulled up, and he can also bring himself to the surface. His dress is full of air, which is pumped into it, and into his helmet. He can let some out, if it is too much. When it is too much it makes him deaf. Sometimes his nose bleeds; but he gets accustomed to it all in time, and does not mind the pressure.—(H.M.I.'s Test.)

376.—A little boy of eight was standing in his nightshirt, drawing sweet sounds from a violin which his father had given him that morning. He had gone to bed at the usual time, but he could not sleep for longing to play on the new instrument. At last, when he thought everyone was asleep, the youngster slipped out of his bedroom, meaning only to look at his treasure.—(H.M.I.'s Test.)

377.—All the parcels are sorted into hampers, and fastened up. You know those great square-looking baskets? When the train stops they are put out, and again sorted in the offices for delivery during the day. The mail-carts carry the bags of newspapers and letters to and from the railway-stations, as you can see for yourselves.—(H.M.I.'s Test.)

378.—A dog of the spaniel tribe with which I am acquainted is on the most comfortable terms with a tabby cat. They seem to understand each other perfectly—the dog actually allowing the cat to sleep in his kennel. If we would but quietly watch pet animals, we should observe much that would be interesting in them, and they would often teach us useful lessons.—(H.M.I.'s Test.)

NEW DICTATION TESTS.

STANDARDS V.—VII.

Suitable for 'Unseen Tests' in Reading also.

No. 345.

THE Czar of Russia is passionately fond of the chase, and makes a point of spending several weeks every year at his magnificent estate in the southern portion of Russia. As soon as he arrives there, the Emperor changes not only his habits, but even his very character. He lays aside the cares and anxieties of State, becomes gay, light-hearted, and genial, and even manifests a disposition to play practical jokes. His entire day is spent in the vast forests, hundreds of miles in extent, which surround the castle on every side, and abound with stags, wild boars, wolves, bears, and every conceivable kind of game.

No. 346.

NAPOLEON was never greater than in the last days of his glory. His escape from Elba and march to Paris have something of the touch of romance about them. He was certainly an adventurer, but one beloved and welcomed by the French people. The exertions he made when restored to power were prodigious. In three months he organised an army of half-a-million of men, and in another three expected to have another million in arms. His attack on the Prussians was masterly. He defeated them, but at the critical hour his physical energies failed him. He became irresolute, and did not follow up his success. He also gave contradictory orders to his generals, and so embarrassed their operations.

No. 347.

THE safe, or treasure rooms, of the leading transatlantic steamers are interesting structures. They are so artfully concealed and contrived and so strongly built that, with a single exception—that of a Pacific liner carrying gold dust on a long voyage—they have never been robbed. In some vessels these safe-vaults are placed amidships, in some aft; but they are always at the bottom of the ship, below everything else, and practically right on the keel. The room is generally some eight or ten feet square and high, and built of iron plates three or four inches thick, and it is furnished with such a formidable array of locks, bolts, and bars as would strike dismay to the hearts of even the deftest and most experienced burglars.

No. 348.

THE Ancient Romans in their armies had a common ensign for the whole legion, which was an eagle of gold or silver, fixed on the top of a spear, holding a thunderbolt in her talons, as if ready to deliver it. The ensign of the foot soldiers, by order of the Emperor Augustus, was a globe fastened on the head of a spear, in token of the conquest of the world. The ensign of the horse was a cloth almost like our colours, spread on a staff. On these were commonly the names of the emperors in golden or purple letters.

No. 349.

THE Swiss 'Good night' refers to the custom of the Swiss mountaineers of calling through their speaking trumpets at dusk, 'Praise the Lord God.' One herdsman starts the call, and his neighbours from every peak echo it. The sounds are prolonged by reverberation from one mountain to another. After a short period, which is supposed to have been devoted to prayer, a herdsman calls 'Good night.' This, too, is repeated, and as darkness falls each retires to his hut. These calls may be heard for miles, and are re-echoed from the rocks for some minutes after the original call has died away.

OFFICIAL CIRCULARS IN BRIEF.

403.—Draws attention to the sliding scale that was adopted in the Necessitous School Boards Act.

404.—The Lords Commissioners of Her Majesty's Treasury hereby give notice that, in pursuance of the power conferred upon them by the Public Works Loans Act, 1897 (60/1 Vict., c. 51. s. 1), they are pleased that the rates of interest chargeable on public loans granted subsequently to the passing of that Act, and secured on local rates, shall be fixed according to the following scale, viz.:—

Not exceeding	30 years	...	2¾	per. cent. per annum.
,,	40 ,,	...	3	,, ,,
,,	50 ,,	...	3¼	,, ,,

It is to be observed that the Act contemplates the adoption of higher rates of interest if at any time the Treasury are of opinion that such action is necessary in the interests of the solvency of the Local Loans Fund.

OUR TUTORIAL SECTION

LONDON MATRICULATION.

June 1898.

BY R. C. B. KERIN, B.A. (LONDON),

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AND

E. J. SCHWARTZ, M.A., B.SC.,

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LATIN.

Course for October.

1. *Vergil, Aeneid,* Book I., lines 198 to 397.

2. *Grammar.*—Read the declension of adjectives in the accidence; the formation of the comparative and superlative; the formation of the positive, comparative, and superlative of adverbs. Note the adjectives and adverbs which are (*a*) compared irregularly, (*b*) defective in either the comparative or superlative. Note the adjectives (*a*) in *-us* and *-er* that are declined like *unus* and *alter*, (*b*) in *-er* that are declined like *acer*. Learn a list of the adjectives that have the gen. pl. in *-um* (most adjectives have *-ium*).

Learn carefully the defective and irregular nouns like *Iuppiter, bos, senex, supellex* (no plural); heteroclite nouns (*i.e.* nouns belonging to more than one declension) like *domus, laurus, vas, ingerum;* heterogeneous words like *locus* (*loci* and *loca* in the plural), *rastrum,* etc.; nouns used only in the singular; nouns used only in the plural; nouns that differ in meaning in the singular and plural (be able to quote at least six of these). Note *nemo.*

In the syntax learn the rules for agreement (the Three Concords).

3. 'Anglice Reddenda,' Nos. 36 to 50.

4. Sentences to be worked from Bradley's 'Arnold' or Bayfield's or Allen's 'Exercise Book.'

Sentences.

4. We did not ask your friend why he did this.

Amicum tuum (vestrum) cur hoc fecisset (faceret) non rogavimus.

Notes.—(*a*) You and your are expressed by *tu* and *tuus* respectively when only *one* person is referred to; by *vos* and *vester* in reference to *two or more* persons. (*b*) The subjunctive *fecisset* is used because it is the verb in a dependent or indirect question. The Romans considered every sentence an indirect question if it was introduced by an interrogative word and was at the same time a dependent sentence. Now in this case we have the interrogative *cur*, hence the subjunctive. N.B.—The Latin subjunctive in such cases must *not* be translated by may or might in English, as there is *no* doubt implied. The words 'may' and 'might' are a very common translation of the Latin subjunctive, and are in most cases erroneously used. (*c*) One of the greatest stumbling blocks to a student of Latin is to know what tense of the subjunctive he has to employ. The rule is this: If the verb in the clause on which the subjunctive depends is in a primary tense (*i.e.* in the present, future, future perfect, or present perfect, *i.e.* the perfect with *have* in English), use either the present or perfect subjunctive; the present if the time of the verb in the subjunctive is the same as, or future to, that of the principal verb; the perfect if the time of the action of the verb in the subjunctive is antecedent to that of the principal verb. *E.g., te rogo cur hoc faciat,* 'I ask you why he does this'; but *te rogo cur hoc fecerit,* 'I ask you why he did this.' If the verb in the clause on which the subjunctive depends is in a secondary or historical tense, *i.e.* a tense that is not primary, use the imperfect or pluperfect subjunctive; the imperfect if the action of the subjunctive verb is the same as, or future to, that of the principal verb, or if the action is continuous; the pluperfect if the action of the subjunctive verb is antecedent to that of the principal verb. *E.g., te rogavi ut hoc faceres,* 'I asked you to do this'; *te rogavi cur hoc fecisset,* 'I asked you why he had done this.' Now in the sentence given above the action of 'doing' may be regarded as either simultaneous with the action or continuous, so we should use the imperfect; or, if we regard the action of 'doing' as antecedent to the 'asking,' we should use the pluperfect subjunctive.

5. After promising to remain at Rome ten days, Balbus told his brother that he would go to Syracuse within fifteen days.

Balbus cum se Romae decem dies mansurum promisisse (or *Balbus se . . pollicitus*), *fratri suo se Syracusas quindecim diebus iturum dixit.*

Notes.—(*a*) The verbal noun after the prepositions 'after,' 'without,' 'instead of,' etc., is not to be translated by the gerund in Latin. 'After promising' = 'having promised' = *pollicitus. Polliceor* is a deponent verb, and has a perfect participle with an active signification. If, however, you wanted to use *promitto*, you would have to write *cum . . promisisset* (lit. 'when he had promised') which is one of the commonest ways of supplying the want of the perfect participle active. (*b*) The future infinitive is used after verbs of promising (see last month, (1) and (2)). (*c*) *Mansurum* agrees with *se*, its subject, which is accusative masculine singular. (*d*) *Se* is used instead of *eum* when the subject of the infinitive is a personal pronoun 3rd person, and is the same as the subject of the verb on which the infinitive depends. (*e*) 'Place where' is generally expressed by '*in*' and the ablative. With names of towns and small islands, however, the genitive is used if the name of the town is a singular word of the first or second declension, otherwise the ablative without a preposition is used. Hence *Romae* above. (*f*) Verbs of 'telling' and 'giving' take the dative of the person, hence *fratri*. (*g*) *Suo* is used, not *eius*, because it refers to the subject of *dixit*. (*h*) For the future infinitive *iturum* see (i) last month. (*i*) Note that *Syracuse* is in Latin *Syracusae*, a plural word 1st declension. For the accusative see (2) (*c*) last month. (*k*) *Dies* is in the accusative expressing duration of time.

6. Each of us promised to go to Athens as soon as possible.

Nostrum quisque se Athenas quam celerrime iturum promisit.

Notes.—(*a*) *Nostrum* is a *partitive genitive*, *nostri* an *objective genitive*. Here 'us' denotes the whole of which a part, 'each,' is taken, hence we use the partitive genitive *nostrum*. (*b*) For the accusative (*Athenas*) of 'motion to' see last month. (*c*) For the future infinitive see last month. (*d*) Note again the insertion of the subjective of the infinitive *se*. For reason why *se* is used and not *eum*, see Excercise (4) above.

Sentences for practice, embracing the rules already given:—

1. After threatening (*minor*) to kill the soldiers, he marched with all speed (= as quickly as possible) to Capua.
2. No one had asked your friend why we went to Rome.
3. No one ought (*debeo* with infinitive) to tell him why we spared (*parco* governing dative) the soldiers.
4. I cannot tell you when (*quando*) he went away with (*cum*) his friend.
5. Each of us heard that you were remaining at Rome for fifteen days.
6. After hearing that your brother was stopping at Syracuse he determined (*constituo*) to tell you this.
7. Each of the soldiers stated that they had met (*convenio*) this man.
8. Who threatened to tell your father this?
9. We asked who threatened to tell your father this.
10. No one of us could ask your brother why he went from Rome to Athens.

Vergil.

201. *accestis.*—Note the contracted form (syncope).

203. *forsan*, 'perhaps,' generally followed by the subjunctive.

208. Distinguish *rĕfert* (as here) 'relates,' from *rēfert*, 'it is of importance.' Students should note words that differ only in the quantity of their vowels.

211. *viscera*, 'flesh,' not necessarily 'entrails.'

212. *secant.*—Note plural verb with singular subject *pars.*

216. *epulis*, instrumental ablative.

218. *seu . . sive*, 'whether . . or.' In prose we should find *utrum . . an*, as this 'whether . . or' clause is a dependent question clause.

225. *vertice*, ablative of 'place where' without a preposition. In prose we should find a preposition.

228. *oculos suffusa.*—In Latin poetry the pass. perf. part. is often found governing an acc. case. This is considered as an imitation of the Greek use of the middle voice.

237. A good instance of Vergil's 'inversion.' We should say 'why hast thou changed thy opinion?'

242. *Achivis.*—Ablative of separation.

244. *Timavus.*—Know its position.

247. *Patavi.*—This gen. of definition after *urbem* would not be regular in Latin prose; cf. *urbs Roma*, 'the city of Rome.'

249. *compostus.*—Syncopated form for *compositus*.

251. *amissis navibus.*—Abl. abs., 'after losing our ships.'

252. *oris.*—Abl. of separation.

254. *olli.*—Archaism for *illi*.

257. *metu.*—Old dative. Archaism. Distinguish *mānent* (*manse*) from *mănent* (*mane*).

267. *Iulo.*—Note the attraction.

268. *dum res . . regno.*—Either 'while fortune lasted for the Ilian kingdom' (Wagner) or 'while the Trojan state stood with power unbroken' (Conington). In the latter case *regno* is abl. of respect.

279. *quin*, 'nay.'—Distinguish this use of *quin* from its use with the subjunctive = "that."

284–286. Allusions important.

287. *terminet.*—Subjunctive, expressing purpose.

291–293. Allusions very important.

297. *genitum Maia* (Mercury).—Abl. of origin.

301. *remigio alarum*, 'winged oarage.'

305. Note that the word *pius* is wider in meaning than our 'pious.' It is an epithet applied to people who have performed their duty to those to whom they are under an obligation. Here it refers especially to Aeneas' filial affection.

307. *accessurit.*—Subjunctive in a dependent question.

312. Note *comitatus* with abl. of agent without the preposition.

317. *Hebrum.*—Geographical position important.

319. *diffundere.*—Poetical use of the inf. (Graecism).

320. *genu.*—Acc. of respect; another Graecism.

326. *mihi.*—Dat. of the agent. Abl. with *a* or *ab* would be usual in prose.

327. *memorem.*—Deliberative subjunctive.

330. *sis.*—Optative subjunctive.

346. *ominibus.*—'Omens' of the marriage, and so the marriage 'rite' (Conington).

350. *securus* does not mean 'secure' in classical Latin, but 'free from care,' and here, 'careless of.' Distinguish *sĕcuris* (*securus*) from *sĕcuris* ('Axe').

357. *excedere.*—The use of the inf. after verbs of persuading (suadeo) is poetical when in English 'to' and the infinitive are used.

374. Note *ante* separated from *quam* (tmesis).

377. *oris.*—Poetical dative of 'motion to' instead of the prose construction of *ad* and the accusative.

381. *denis.*—Distributive numerals are used in multiplication, cf. *bis bina*, 'twice two.'

387. *qui* is here *causal* (= since thou), hence the subjunctive *adveneris*.

389. *perfer.*—Note that *dico*, *duco*, *fero*, and *făcio* drop the *e* in the 2nd per. sing. of the pres. imper. act.

391. *versis aquilonibus.*—Abl. absolute.

394. Distinguish *plăga* (tract) from *plāga* (stroke).

397. Distinguish *redūces* from *rĕdūces* (verb).

Errata.—In the Course for September last month, p. 143, in Grammar notes, for 'acc. sing. in *-um*' read 'acc. sing. in *-im*.'

FRENCH.

Course for October.

1. A certain amount of translation and a certain number of exercises from English into French each week.

2. Grammar.—Learn the general rules of gender. The methods of ascertaining gender by derivation and termination should be known. Note the words that differ in meaning in the masculine and feminine. Note the words *amour*, *délice* and *orgue*, which are masculine in the singular and feminine in the plural. Note rules for the gender of *gens*, *Pâques*, *chose* and *personne*:—*Personne* when a noun, is always feminine—hence *La personne est supérieure* but *Personne* (no one) *n'est supérieur*.

The rules for the formation of the feminine are very important. Note especially how words in *-x*, *-c*, *-gu*, *-et*, *-ien*, *-el*, *-eil*, *-on*, and *-eur* form their feminine. Note the adjectives that have two forms for the masculine singular and one for the feminine, as *vieux*, etc. Note *grec*, feminine *grecque*, but *turc*, *turque* and *caduc*, *caduque*. Note *Suisse* (noun), feminine *Suissesse*; *suisse* (adjective), feminine, *suisse*; cf. *nègre*, *borgne* and *pauvre*, which when used (*a*) as nouns, change *-e* into *-esse* for the feminine, (*b*) as adjectives, do not change for the feminine. Distinguish the feminines of *pêcheur* ('fisherman'), and *pécheur* (sinner). Note the feminine of *le général*, viz., *la générale*, 'the general's wife,' cf., *le maréchal*, *la maréchale*. Note *le héros*, feminine *l'héroine* (*h* is aspirate in *héros*, but *mute* in its derivatives). Note the two feminines of *béni*, *demandeur*, *débiteur*, *chanteur*, *chasseur*, *franc*. It will repay our readers to constantly refer to the words that form the feminine irregularly. Note the masculine words like *mulet*, that are apparently formed from the feminine.

Learn the rules for the formation of the plural of compound adjectives. Note especially (*a*) compounds of *nouveau*, (*b*) compound names of colour, like *gris*, *blanc*, etc. Note the rule for the variation of *tout* (quite) with adjectives.

ENGLISH.

Course for October.

1. Grammar, 'Pronouns.'

Note the definition and classification of pronouns; the definitions of the various classes of pronouns; the advantages of the use of pronouns; the etymology and history of the personal pronouns, especially the history and development of the second and third personal pronouns; history of *its*, *mine*, *thine*; anomalies of the word '*self*'; double possessives; origin and development of the interrogative and relative pronouns; relative age of the relative pronouns; refutation of the Addisonian phrase, 'the Jack Sprat that,' uses of *that*, *which* and *who*; use of *as* as a relative pronoun; etymology and uses of the indefinite and distributive pronouns; chief syntactical rules affecting pronouns; discussion of phrases like 'it is me,' 'if an ox gore a man or a woman so that they die,' 'of gold let the candlestick be made, let *his* shaft be of the same,' etc.

2. History, from the death of Alfred to the death of William I.

Note the Danish Invasion; First king of England; battle of Brunanburgh; life and policy of Dunstan; massacre of St. Brice's Day; Danegelt; ship money; life and policy of Canute; Godwin; Edward the Confessor; the claims of Harold, William, and Edgar Atheling to the English throne; the battles of Stamford Bridge and Hastings (a map of the latter battle is sometimes required); the progress, completion, and results of the Norman Conquest, with a description of the various revolts; lives of Edwin, Morcar, Hereward the Wake, Waltheof and Lanfranc; the various Anglo-Saxon institutions; the rise and development of these institutions in England; division of the soil; folc land and bole land; hundreds and tithings; various classes; earls, aldermen, gesiths, theigns, ceorls, serfs; various courts of justice; hundred mote; folc mote; shire mote; witenagemote; hall mote; modes of trial; sac and soc; compurgators; heriot; wergild; mund; frankpledge; trial by ordeal; the feudal system and its peculiar features (*a*) in England, (*b*) in France; feudal incidents, aids, primer seisin, fine, escheat, wardship, marriage, forfeiture, relief, tenants-in-capite, tenants paravail, ceremonies in conferring a fief; curfew bell; Domesday Book; New Forest; means by which William I. kept down (*a*) the English, (*b*) the Normans.

MATHEMATICS.

Geometry Course.

This month the student should finish the reading of Euclid's first book, not omitting a revision of the earlier portion and the working of some of the problems.

Carefully get up those propositions dealing with the identical equality of triangles, and read the note on this subject following I. 26 in Hall and Stevens.

The following are the solutions of the questions set in last month's course:—

1. By I. 20—

OA, OB are together greater than AB.
OB, OC ,, ,, ,, BC.
OC, OA ,, ,, ,, CA.

Adding these results and dividing the resulting equality by 2 we get—

OA, OB, OC together greater than half the sum of AB, BC, CA.

By I. 21—

BA, AC are together greater than BO, OC.
AC, CB ,, ,, ,, AO, OB.
CB, BA ,, ,, ,, CO, OA.

Proceeding as in first case we conclude that

BA, AC, CB are together greater than the sum of AO, BO, and CO.

2. One proposition is said to be the converse of another when the hypothesis of the former is the conclusion of the latter, and the conclusion of the former is the hypothesis of the latter.

Converse propositions are not of necessity true. For example, consider the proposition 'If I have passed the London Matriculation, then I have studied geometry.' Its converse 'If I have studied

geometry, then I have passed the London Matriculation,' is clearly not necessarily true. The converse of I. 17 is Euclid's 12th axiom.

3. Let P and Q be the two given points, and AB the given straight line. Bisect PQ in R, and at R draw RC perpendicular to PQ, cutting AB in C.

Then C is the required point.

For in triangles CRP, CRQ we have—

RP = RQ,
CR common,
and $\angle$ CRP = $\angle$ CRQ, being right angles.

$\therefore$ $\triangle$s CRP, CRQ are equal in all respects.

And $\therefore$ CP = CQ.

4. Let ABC be a triangle.

Take any point D in BC and join AD.

By I. 16—

$\angle$ ADC is greater than $\angle$ ABC,
$\angle$ ADB ,, ,, $\angle$ ACB.

Adding $\angle$s ADC, ADB are together greater than $\angle$s ABC, ACB.

And since by I. 13 the former two angles are equal to two right angles,

$\therefore$ $\angle$s ABC, ACB are together less than two right angles.

We append a few exercises :—

1. If D be the middle point of the side BC of a triangle ABC, and E the middle point AD, and if BE produced meet the side AC in F, then AF is one-third of AC.

2. Construct a square which shall be equal in area to three times a given square.

3. What is the angle of a regular hexagon?

Arithmetic Course.

The student may this month confine himself to Chapters XVI., XVII., XVIII. of Pendlebury. Of these, Chapter XVI. will need careful attention, as the methods there explained are probably new to most of my readers. Needless to add, facility in approximate work can only be obtained by working of plenty of exercises.

We append an example in this work :—

Find in centimetres to two decimal places the length of the circumference of a circle whose radius is ·01235 cm. (circumference = 3·14159 times diameter.)

Solutions to questions set last month :—

1. $\frac{3}{28}$ reduces to a recurring decimal because its denominator 28 contains a factor 7, for it is only fractions whose denominators contains no other factors but two's and five's that can reduce to terminating decimals.

2. $\frac{5}{7} = \frac{5}{7}$14285. In dividing by 7 we can only get six different remainders, viz., 1, 2, 3, 4, 5, and 6, so that if the remainder has not recurred up to a quotient of six figures it is bound to recur at the seventh.

3. $\frac{1}{1.2} = \cdot 5$.

$\frac{1}{1.2.3} = \frac{1}{3}$ of $\frac{1}{1.2} = \frac{1}{3}$ of ·5 = ·16666.

$\frac{1}{1.2.3.4} = \frac{1}{4}$ of $\frac{1}{1.2.3} = \frac{1}{4}$ of ·16666 = ·04166.

Proceeding thus we get for our answer 1·7182.

Note that it is necessary to work to five places at least so as to get correct to 4.

4. 3·14285£
20
2·85700s.
12
10·284 = 10¼d. approximately.

Ans. £3 2s. 10¼d.

5. We here have simply to multiply 1 franc. 25 cent. by 25—

125 cent.
25
3125 cent. = 31 francs 25 cent.

Algebra Course.

Chapter XVII. of Hall and Knight should be carefully read up, and every third example all through this chapter should be worked.

Note the three important formulæ :—

$$a^2 - b^2 = (a - b)(a + b),$$
$$a^3 - b^3 = (a - b)(a^2 + ab + b^2),$$
$$a^3 + b^3 = (a + b)(a^2 - ab + b^2).$$

The following is the solution to the problem set last month :—

Let A, B, and C be the three men, and let

x£ be laid on A,
y£ ,, B,
z£ ,, C.

Then if A win $2x$£ will be gained, whereas y£ and z£ will be lost, so that—

$$2x - y - z = 3\tfrac{1}{2}. \quad (1)$$

So also if B win we get—

$$3y - x - z = 3\tfrac{1}{2}. \quad (2)$$

And if C win—

$$4z - x - y = 3\tfrac{1}{2}. \quad (3)$$

Subtract (2) from (1) we get—

$$3x - 4y = 0. \quad (4)$$

To four times (3) add (4), giving—

$$11y - 5x = 16\tfrac{1}{2}. \quad (5)$$

Solving (4) and (5) in ordinary way we get—

$$x = 5,\ y = 3\tfrac{3}{4}.$$

Substituting in (1) we find—

$$z = 3.$$

So that the amounts required are £5, £3¾, and £3.

We append a few examples to be solved by our readers :—

1. Factorise $(x^2 + 8)^2 - 16x^2$, and hence resolve $x^4 + 64$ into the product of two factors.

2. Show that if
$x = y$ then $(3x \times y - 5)^3 - (2x + 2y - 5)^3 = 0$.

3. Factorise $x^6 + x^3 - x^4 - x$ and $x^6 - 1$.

Hence reduce $\frac{x^6 - x^3 - x^4 - x}{x^6 - 1}$ to its lowest terms.

4. If $a + b = x$, $a - b = y$, express $a^3 - b^3$ in terms of x and y. Hence evaluate $5002^3 - 4998^3$.

Mechanics Course.

Chapters XIII. and XIV. of Loney should be thoroughly got up, and all or nearly all the examples worked. All this work, with the exception of Arts. 188 and 189, is of great importance.

The importance of getting a thorough grasp of the principles described in these chapters cannot be overestimated. Newton's three 'laws of motion' are to be committed to memory; Arts. 179, 180, 181, 182, 184 are to be carefully studied, and a description of Atwood's machine should be read.

Just a few words on the meaning of the term 'mass,' which may be found described in text-books as 'quantity of matter.' Now, quantity of matter is measured by comparison with a certain piece of platinum kept at the Exchequer known as one pound. Any body containing a quantity of matter equal to this piece of platinum would be said to be of mass 1 lb.

We must now define what we mean by 'equal quantity of matter,' or, in technical language, 'equal mass'; the following is our definition :—

'Two bodies are said to have equal masses when, if the same force act on them in the same way for the same time, it produces the same change of velocity.'

We are now in a position to measure masses by a comparison with this standard 1 lb.; for example, if 16 equal masses taken together form a mass equal to 1 lb., each of these 16 masses would be $\frac{1}{16}$ lb., or 1 oz. according to our measures.

The 'weight of a pound' is the *force* of attraction between the earth and the mass of 1 lb. Unlike mass, it is bound up with the existence of two things, a body to be weighed, and the earth or some other attractive body. It is a fact established by experiment that all bodies fall at the same rate, *i.e.* with the same acceleration (this may readily be verified by placing a small piece of paper on the upper side of a penny and letting both fall to the ground, which they reach together). So that if a 2 lb. and a 1 lb. mass be let fall simultaneously at the end of any given time, their velocities being the same and the mass of one being double that of the other, the momentum of the 2 lbs. is twice that of the 1 lb., and hence by Newton's 2nd law the force acting on the 2 lbs. is double that on the 1 lb., or the weight of the 2 lbs. mass is double that of the 1 lb. mass, *i.e.* the weights of these two bodies are proportional to their masses. This latter fact is deduced directly from the fact that all bodies fall with the same acceleration; if some substance were discovered that fell quicker than other substances it would no longer hold good.

To make this fact quite clear, if two trains, A and B, of which A is twice as large as B, leave a station simultaneously and move along with exactly the same acceleration, the pull of the engine on A must be twice as great as that on train B; similarly, if masses of 2 lbs. and 1 lb. are observed to fall at the same rate, the pull of the earth on the 2 lbs. must be twice as great as its pull on the 1 lb., or the weight of the 2 lbs. mass must be twice that of the 1 lb.

For those who find Art. 173 difficult, I would suggest as an alternative method the following :—

A mass of 1 lb., if let fall under the action of the earth's attraction, which is under the action of its weight or a force of 1 lb., has an acceleration of 32 ft./sec.^{2}, or more shortly,

1 lb. force acting on 1 lb. mass produces an $f = 32$.

$\therefore \frac{1}{32}$ lb. ,, ,, 1 lb. ,, ,, $f = 1$.

or

1 poundal acting on 1 lb. mass produces an $f = 1$.

$\therefore$ P ,, ,, 1 lb ,, ,, $f = $ P.

$\therefore$ P ,, ,, m lbs. ,, ,, $f = \frac{P}{m}$.

$\therefore$ for these units we have

$$P = mf.$$

Note that an ordinary balance compares masses, whilst a spring one compares weights.

We append a few examples and questions.

(1) A train of mass 100 tons starts from a station and attains with a uniform acceleration a velocity of 30 miles an hour at the end of five minutes. Find the force exerted by the engine.

First we find the acceleration.

$v = 44$ ft. per sec. $\quad v = ft.$
f ? $\quad \therefore 44 = 300 f.$
$t = 300$ sec. $\quad$ or $f = \frac{11}{75}$ ft./sec.^{2}

To find the force required,

$$P = mf$$
$$= \frac{224000 \times 11}{75} \text{ poundals}$$
$$= \frac{224000 \times 11}{75 \times 32 \times 2240} \text{ tons}$$
$$= \frac{44}{96} = \frac{11}{24} \text{ ton.}$$

In connection with this sum we may remark that it is useful to remember that 60 miles per hour = 88 ft. per sec.

Note that if m be in lbs. and f in feet and seconds, P comes out in poundals ; if for lbs. we substitute grammes, and for feet we have centimetres, P will be in dynes. Remember

32 poundals = 1 lb. weight.
981 dynes = 1 gramme weight.

(2) A boat mass 1000 tons, whose engines exert a propelling force of 100 tons, moves with an acceleration of 1 ft. per sec. per sec. What is the resistance of the water?

Here the force producing the motion is $(100 - R)$ tons, or $32 \times 2240\ (100 - R)$ poundals, where R tons is the resistance of the water.

Hence we have

P = $32 \times 2240\ (100 - R)$ poundals $\quad P = mf$
$m = 2240000$ lbs. $\quad = 32 \times 2240\ (100 - R)$
$f = 1$ $\quad = 2240000 \times 1$
$\therefore 32(100 - R) = 1000$

leading to R = $68\frac{3}{4}$ tons.

(3) A force of R tons acting on 10 tons moving initially at rate of 60 miles per hour stops it in 1 min. Find R.

First we find f, the retardation.

$u = 88$ ft. per sec. $\quad v = u - ft.$
$t = 60$ sec. $\quad 0 = 88 - 60f.$
f ? $\quad \therefore f = \frac{22}{15}$ ft./sec.
$v = 0$

We now have

P = R tons $\quad P = mf$
$= 32 \times 2240$ R poundals $\quad = \frac{32 \times 2240 \text{ R}}{22400 \times 22}$
$m = 10$ tons $\quad = \frac{15}{15}$
$= 22400$ lbs.
$f = \frac{22}{15}$ $\quad \therefore 8 \text{ R} = \frac{11}{3}$
or R = $\frac{11}{24}$ ton.

(4) Without the use of any rule, find the acceleration produced by 28 lbs. force acting on a mass of 4 cwt.

We know that

1 cwt. force gives 1 cwt. mass an acceleration of 32 ft./sec.^{2}
or 112 lbs. ,, 1 cwt. ,, ,, 32 ,,
$\therefore$ 28 lbs. ,, 1 cwt. ,, ,, 8 ,,
$\therefore$ 28 lbs. ,, 4 cwt. ,, ,, 2 ,,

We append a few questions on bookwork, to which, however, we shall not publish the answers, as they may be found in the pages of our text-book.

(1) Define a poundal, a dyne, the weight of 1 lb., and the mass of 1 gramme.

(2) Enunciate Newton's laws of motion. What is meant here by the term law ? What reasons have we for believing the truth of these laws ?

(3) How may 'Atwood's machine' be used to measure the acceleration produced by a given force acting on a given mass?

(4) State experiments by Atwood's machine verifying the formula $P = mf$ and illustrating the fact that the space passed over by a body moving with constant acceleration is proportioned to the square of the time of motion.

CHEMISTRY COURSE.

Having got some insight into the principles of Chemistry, it will be advisable to study some of the commoner of the elements. To this end the student had better carefully master all that Jago gives on oxygen and hydrogen up to the end of Chapter VI., not omitting to perform some of the experiments there described, such as the action of sodium on water, the preparation of O and H, and others.

It is a good plan to have a note-book, in which should be entered your *own* description accompanied by diagrams of all experiments performed or seen.

A good text-book to read in conjunction with Jago is 'Sexton's Inorganic Chemistry,' which is rather fuller on the theoretical portion of the subject.

OUR L.L.A. COURSE.

HONOURS EDUCATION.

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SECOND PAPER.—SPENCER'S EDUCATION, CHAPS. II.-IV.

(1.) *Digest.*

CHAP. II., INTELLECTUAL EDUCATION.—This chapter, the importance of which cannot well be over-estimated, divides itself into four chief divisions, of which the heads are :—**I. Introduction**, pp. 50–64 ; **II. Theory of Education**, pp. 64–71 ; **III. The Practice of Education**, pp. 71–89 ; **IV. Two General Principles**, viz., **Self-instruction** and **Pleasant Acquisition**.

I. Introduction.—'Some centuries ago there was uniformity of belief—religious, political, and educational.—All men were Romanists, all were Monarchists, all were disciples of Aristotle, and no one thought of calling into question that grammar school routine under which all were brought up.' This blind unquestioning following of the traditions of the elders applied to *religion*, to *government*, to *recreation*, and to *trade*. 'Believe and ask no questions' applied throughout, and the unanimity of the ignorant reigned supreme. But the march of progress has changed all that, and nowhere has the march been more certain than in education, where this unanimity of stagnation has yielded place to the less comfortable but infinitely more profitable 'disagreement of the inquiring' through which educational doctrine is passing as through fire. Ultimately this inquiring spirit, happily at last abroad, will, it is hoped, hap upon the true method, and another and a better unanimity will reward the labours of the seekers after this goodly pearl of true educational doctrine. But this unanimity of the wise is not yet, and we must be content with the spirit of inquiry which by reason of the disagreement is searching in divers and diverse directions.

Contrasts between the old and the new in education.

(1) *Physical education* is becoming common. 'The man must be a good animal.'

(2) The *text book* parrot type of teaching is yielding place to oral instruction.

(3) *Rote-learning* is falling into discredit, and associations of reasoning are relied upon in memory training in place of mere verbal associations, as was formerly the case. 'To know by heart is not to know'—*i.e.*, so long as the meaning is not grasped, apart from the words, there is no real knowledge at all.

(4) *Rule-teaching* is now condemned as producing the appearance without the reality of knowledge. The upward progress from particulars to generalisations (Inductive or Analytic method) is more and more preferred. 'Whilst the rule-taught youth is at sea beyond his rules, the youth instructed in principles solves a new case as readily as an old one.'

(5) '*Abstractions* are left untaught until the mind has been familiarised with the facts from which they are abstracted' (Concrete before Abstract). Hence grammar should not be taught to children, respecting which see criticism below.

(6) *Sense-training* is systematically practised. Hence the 'well conceived but ill-conducted' system of

(7) *Object lessons*, which at least illustrates the presentation of truths in the concrete, and points to the time when science shall be taught experimentally all along the line.

(8) The *acquisition of knowledge* is being reduced to a *pleasurable* activity, and thus there is an increasing

(9) *Conformity to Nature*, as is shown by the tendency in the direction of Pestalozzi's principle that there is a certain sequence in which the faculties spontaneously develop, and a certain kind of knowledge which each requires during this development, to which end the curriculum is receiving attention and the teacher is becoming a benevolent superintendent who must direct the pupil in his learning because of the complexity of mind.

The introduction concludes with an examination into the character, the inconsistencies, the principles, and the methods of Pestalozzi.

II. The Theory of Education. Seven principles.

(1) From simple to complex.

(2) Mind-development advances from the indefinite to the definite.

(3) From concrete to abstract.

(4) The child learns as the race learned.

(5) From the empirical to the rational.

(6) Self-development to be encouraged to the uttermost.

(7) Healthy education must evoke pleasurable activity.

III. The Practice of Education (1) should begin with the babe in the cradle, but not (2) as Pestalozzi taught spelling, which opposed (3) what psychology directs, viz., that a sufficiency of objects presenting the most elementary sensations with the widest possible difference between them should be provided, providing the undecomposable simple sensations out of which the more complex perceptions and emotions are formed, so that from simple to complex should obtain from the cradle to the grave. (4) Object Lessons should be lessons from objects, the object speaking as much, the teacher as little, as possible; furthermore, object teaching should be widely extended to the teaching of science, and indeed of every subject whatsoever where instruction can be obtained first hand from things in place of last hand from words, for 'in aiding the child to acquire the out-of-door information for which it shows so great an avidity, and in encouraging the acquisition of such knowledge throughout youth, we are simply inducing it to store up the raw material of future organisation—the facts that will one day bring home to it with due force those great generalisations of science by which actions may be rightly guarded. (5) Drawing should be of natural objects in their natural colour, for '*the question is not whether the child is producing good drawings. The question is whether it is developing its faculties.*' Geometry and Perspective should be taught experimentally and inductively—*i.e.*, not from laws to examples, but *from examples to the laws which they exemplify*. This is further illustrated by the dicta of Mr. Wyse and Prof. Tyndall, and by a reference to that inventional geometry which was practised by Spencer's father, who wrote a book on the subject. The claim of this kind of geometry to be called rational will not be disputed.

All education should be on like principles, since this is the one type of true method. The chapter concludes with the claim that *all education should be a development or evolution of self*, and that it should moreover be a *happy activity*, thereby tending to incite the student of larger growth to continue that process of education which, as memory testifies, was a source not only of profit but also of continuous pleasure, to the end that the child having become a man should acknowledge the truth of the statement that one's education is never finished, and that in the most sincere way, viz., by voluntarily continuing to educate himself.

(2.) *Criticism.*

The old and the new in education. '*The old education* had one object, and that was learning. Man was a being who learned (by rote) and remembered. Education was a process by which he learnt, at first the languages and literatures of Greece and Rome only; but, as time went on, the curriculum was greatly extended. *The new education* treats the human being not so much as a learner as a doer and creator. The educator no longer fixes his eyes on the object—knowledge—but on the subject—the being to be educated. The success of the education is not determined by what the educated *knows*, but by what they *do* and what they *are* . . . . When we have ascertained what are the faculties to be developed, we must consider further how to foster the self-activity that will develop them.'

Learning by rote.—Michael Eyquem de Montaigne, the famous French essayist, whose 'sçavoir par cœur n'est pas sçavoir' is to be found in his essay on Pedantry, lived from 1533 to 1592. He is justly credited with having done much to turn men's minds against the mischievous illusion that memory is mind or that knowledge is education. He is thus one of the most esteemed of reformers, whose famous saying, 'It is not a soul, it is not a body that we have to train up, and we must not divide him,' is an eloquent definition of the scope of education. Another of his sayings is a further indictment of the learning-by-rote fallacy: 'We may become learned from the learning of others; wise we can never be except by our own wisdom.'

Grammar after and from Language.—Claude Marcel (1793–1876), to whom Spencer refers some half-dozen times, had been one of Napoleon's soldiers. He emigrated to Cork and became French consul at that city in 1848. He undertook the education of his nine children himself, and zealously studied the art of education to this end. As a result of this practice and study he was able to write his 'Language as a means of Mental Culture,' which was published by Messrs. Chapman & Hall in 1853. The quotation on p. 59 of Spencer's Education is the first of Marcel's 'Twenty Axiomatic Truths of Methodology,' for which see the Appendix to Quick's Reformers. In 1865 Marcel returned to Paris and became a member of the Society for Elementary Instruction, and was rewarded for his labours by the ribbon of the Legion of Honour. Both Quick and Jos. Payne speak well of Marcel's work.

It is worthy of note that the teaching of grammar by word-building and sentence-making is becoming very popular in the primary schools; the Phonic system of learning to read, which is advocated on p. 62, is also widely used; and again, we do teach the multiplication table experimentally, and actual weighing and measuring are now by no means uncommon as a prelude to calculations in weights and measures.

Conformity to Nature, Pestalozzi, 1746–1827.—This celebrated Swiss reformer, the author of 'Leonard and Gertrude,' and the apostle of the new education, we shall study in detail when taking Quick's Reformers. Spencer's criticism of him is a just one.

Auguste Comte (1795–1857), Professor of Mathematics at the École Polytechnique, was the author of 'Positivism,' of which Mr. Frederic Harrison is now the chief exponent in this country. The statement that Spencer imputes to Comte should rather be set to the credit or otherwise of Condillac, who formulated a scheme of instruction which was intended to make the child's education 'accord both in mode and in arrangement with the education of mankind considered historically.'

W. H. Payne, in his 'Contributions to the Study of Education,' writes thus in refutation of this doctrine: 'Mr. Spencer's proof of this doctrine is to this effect: What is true of the aggregate is true of each unit forming the aggregate; the race acquired its knowledge in a certain way, and therefore each individual of the race must acquire his knowledge in the same way. The word MUST in Mr. Spencer's thought, at once involves us in a curious dilemma. Had he said SHOULD or OUGHT we might be forewarned against an error; but if it is true that there is but one way in which the individual can gain his knowledge, as Mr. Spencer declares, then error is impossible: the current mode of acquisition is the normal mode, and to preach a reform in this particular is an inexcusable waste of breath. But, as a matter of fact, Mr. Spencer prescribes a radical reform; it follows, therefore, that the genesis of knowledge in the individual need not of necessity be the same as the genesis of knowledge in the race. The only form in which the question can be discussed is this: Should the individual gain his knowledge in the same way in which the race as a whole gained its knowledge? . . . It will be granted that in knowledge, as in wealth, the race has made progress from age to age, and even from generation to generation. Now progress is possible only under this condition: *inheritance supplemented by individual acquisition.* Without inheritance there can be no progress, for then each generation must start where the preceding generation started; and progress is quite impossible without individual acquisition, for in this case each generation must stop where the preceding generation stopped.'

M. Compayré says, 'There is doubtless an element of truth in the error of Condillac that sciences and arts began with the observation of particulars, and thence slowly rose to general principles; and to-day no one thinks of denying the necessity of proceeding in the same manner in education, so far as this is possible. It is well at the first to present facts to the child and to lead him step by step, from observation to observation, to the law which governs them and includes them; but there is a wide difference between the discreet use of the inductive and experimental method and the exaggerations of Condillac. No one would seriously think of absolutely suppressing the sympathetic method of exposition, which, taking advantage of the work accomplished through the centuries, teaches at the outset the truths that have already been acquired. It would be absurd to compel the child to painfully recommence the toil of the race.'

The Seven Principles.—Concerning (1) nothing need be said. (4) has already been discussed.

(2) Experience teaches the truth of this law, and to set out with crude notions which are made clear by the correction first of the grossest and then successively of less marked errors is a course which we must be content to follow. 'The normal state of a child's knowledge is that of confusion, vagueness, and indefiniteness.' (W. H. Payne.)

(3) 'In conformity with this principle Pestalozzi made the actual counting of things precede the teaching of abstract rules in Arithmetic. Basedow introduced weights and measures into the school, and Mr. Spencer describes some exercises in cutting out geometrical figures in cardboard as a preparation for geometry. The difficulty about such instruction is that it requires apparatus, and apparatus is apt to get lost or out of order. But if apparatus is worth anything at all it is worth a little trouble. There is a tendency in the minds of many teachers to depreciate "mechanical appliances." Though such appliances will not enable a bad teacher to teach well, nevertheless, other things being equal, the master will teach better with them than without them. There is little credit due to him for managing to dispense with apparatus: an author might as well pride himself on being saving in pens and paper.'

(5) As to this, Professor Sully says, 'The chief differences between empirical and scientific knowledge are the following:—(1) The former is based on a narrow range of observation, and on observation which is apt to be loose and inexact; the latter on a wide survey of facts and on accurate processes of observation and experiment; (2) The former consists of propositions which have only a limited scope, and are never, strictly speaking, universally true; the latter is made up of propositions of wide comprehensiveness and of universal validity known as principles or laws; (3) As a result of this the conclusions deduced from empirical knowledge are precarious, whereas the conclusions properly drawn from scientific principles are perfectly trustworthy.

(6) The fact that we take most delight in the work of our own hands is sufficient warrant for this. Hence the wise teacher encourages his children to question him, and endeavours to get one boy to answer the questions asked by another. Hence, also, the charm of manual work and practical science. That 'we learn to know by doing' is another proof of the soundness of this rule.

(7) Everybody admits the desirability of this, although it is not easy to see how it is possible to make all subjects which must be taught directly pleasurable to children. If uninteresting in itself, the subject should be shown to be interesting in its results, or borrowed interest should be infused into it by sympathy, which may beget a transference of enthusiasm from the teacher or interested pupil to the uninterested; but all training should aim at culminating in the infusion of a love of knowledge for its own sake. 'Perhaps a love of knowledge for its own sake, or a confirmed taste for intellectual improvement, is the highest and most comprehensive motive that the teacher can seek to establish' (W. H. Payne). 'In the study, as elsewhere, pleasure could not be continuous and unmixed. There, as elsewhere, it must be bought by effort, painful perhaps at the time; but there, as elsewhere, it serves as a reward for the activity which lends itself to the renewal of effort. Such is the universal law' (Professor Joly).

'The apt teacher succeeds not by amusing his pupil, but by sympathising with him and gaining his confidence.'

Compayré and Quick, on the other hand, are in practical agreement with Mr. Spencer. The former says, 'Herbert Spencer has thoroughly demonstrated that the mind really only appropriates the knowledge that affords it pleasure.' The latter says, 'Perhaps a certain amount of such training may train down the mind and qualify it for some drudgery from which it might otherwise revolt; but if this revolt is attained it is attained at the sacrifice of the intellectual activity which is necessary for any higher function.'

Other eminent men referred to by Mr. Spencer in Chapter II.:—

Fellenberg, Philip Emanuel von, 1771–1844, was a Swiss who concerned himself with the condition and education of the poor peasantry, with whom he practically lived for a time in order to thoroughly understand their wants. In 1804 he founded an asylum for forsaken children on his estate at Hofwyl, near Bern. In 1807 he started a school of agriculture, and the next year he opened a Philanthropin, or school for higher class children. In 1830 he opened a Realschule for children of the middle classes, and afterwards a normal school for teachers, so that he had experience with all classes. His aim was to make agriculture the basis of a new system for elevating the lower and rightly training the higher orders of the state and welding them together in closer union.' Through the manual labour of the pupils the school was self-supporting, and it became famous. In 1804 and in 1807 he was associated with Pestalozzi, who, however, could not get on with 'the man of iron,' as he called Fellenberg. Herbart was at one time a teacher with Fellenberg.

Bacon, Francis (Lord Verulam), 1521–1626, 'the wisest, brightest, meanest of mankind,' as Pope calls him. His connection with education is through his philosophy, notably the Novum Organum (New Instrument), wherein was preached the new gospel of learning from things—*i.e.*, by experiment. Comenius, the father of realism in the school, was the professed follower of 'the noble Verulam, who has given to us the true key to nature.'

Mann, Horace, 1796–1859, the most eminent and successful promoter of popular education of his time. For twelve years he was Secretary of the Massachusetts Board of Education, and did much good by the circulation of his Annual School Reports. He became successively a senator and the president of Antioch College.

Pillans, James, 1779–1865, an Edinburgh graduate who taught first at Eton and then became Rector of the Edinburgh High School, which attained to a high degree of excellence under his charge. In 1820 he became Professor of Humanity at his university, and died at the ripe age of 84. He advocated Government inspection of schools, the formation of normal schools, and otherwise showed great enthusiasm for the cause of popular education. His writings on education were published in a volume in 1853 under the title of Contributions to the Cause of Education.

Wyse, Sir Thos., K.C.B., 1791–1862, M.P. for Tipperary 1830–1832, for Cork 1835–1847, afterwards minister at Athens, and then he became a privy councillor. His connection with education was through the Central Society of Education, which issued papers on education, Wyse being responsible for 'Education in the United Kingdom,' 'On the Lyceum System in America,' and 'On the Present State of Prussian Education' in 1837, 1838, and 1840 respectively.

De Morgan, Augustus, 1806–1871, fourth wrangler at Cambridge and Professor of Mathematics from 1831–1836. He wrote some valued standard treatises on Mathematics.

(3) *Hints and Answers.*

The second of Spencer's essays has been dealt with at great length, because it is by far the most important of the series from the standpoint of the examination as well as from that of desert. The student should observe that more than half the questions set each year for the L.L.A. are on this chapter, which should be thoroughly grasped from start to finish. The two remaining essays and part of Locke's Thoughts will be dealt with next month.

L.—It is not necessary to answer all the questions, but it is very desirable. As you will see from each week's list of questions, the same questions are given again and again, so that, as pointed out in a previous issue, you can, by answering all the questions set, be almost certain of having answered the very questions that will be set in June next. This makes question answering of most vital importance. I shall be prepared to go over your work whenever you like to send it, and will read all you send, so that you need not consider me in the matter at all. My advice is, answer every question, if not now, at least later on, although, as each month brings its own work, procrastination will perhaps be dangerous.

J. L.—Yes, the current coupon must always be sent. Yes, to me personally, care of the Editor.

Questions.

1. Explain and fully illustrate the statement, 'General truths to be of permanent use must be earned.'—1888, 1891.

2. State Mr. Spencer's 'Laws of Mental Evolution,' and illustrate them by examples drawn from the schoolroom—1888.

3. How can education be made a 'process of self-evolution'? Explain by examples.—1888, 1892, 1895.

4. What parts of Mr. Spencer's theories have already taken their place in our methods of education, and what parts appear to you to be inapplicable?—1888.

5. State, illustrate, and annotate Mr. Spencer's seven guiding principles of education.—1890, 1893, 1895.

6. Explain—(*a*) In education we should proceed from the simple to the complex; (*b*) The education of the child must accord both in mode and arrangement with the education of mankind; (*c*) Every science is evolved out of the corresponding art.—1891.

7. Describe Tyndall's method of teaching Geometry.—1891, 1893.

8. Explain, illustrate, and criticise any three of the following:—(1) 'Sçavoir par cœur n'est pas sçavoir'; (2) General truths to be of due and of permanent use must be earned; (3) The youth instructed in principles solves a new case as readily as an old one; (4) Grammar is not the stepping stone, but the finishing instrument; (5) Let the child learn the truths of number, form, and relationship in position as the race learnt them; (6) The perfection of the tool becomes in undisciplined hands a source of imperfection in results.—1892.

9. Explain fully what Mr. Spencer means by the method of nature.—1894, 1895.

OUR PUPIL TEACHERS' AND SCHOLARSHIP COURSE.

BY ARTHUR T. FLUX,

Head Master of the Belvedere Pupil Teachers' Centre, First on Scholarship List, Author of 'Scholarship School Management.'

PUPIL TEACHERS' COURSE.

AUTUMN EXAMINATION, 1898.

FIRST MONTH.

See APRIL NUMBER.

SPRING EXAMINATION 1898.

SIXTH MONTH, OCTOBER.

WORK TO BE PREPARED.

A.—*English.*

(Students are invited to write for assistance in case of difficulty not taken in the course.)

First Year.

1. Finish and revise Latin suffixes.
2. Prepare lines 194–223 of the 'Lay of the Last Minstrel,' with all meanings, allusions, &c.

Second Year.

1. Prepositions—their derivation and functions.
2. Revise all prefixes.
3. Prepare lines 613–658 of the Winter Evening, 'Task,' Book IV. Pay special attention to the paraphrase.

Third Year.

1. Learn 20 roots and meanings per week.
2. Prepare lines 441–539 of 'Comus.' Pay special attention to the paraphase.

Notes.

Line 196. May be taken 'he bent his sinewy frame' or as it stands.
196. *Amain.* Adv. of manner from A. S. Maegen.
197. *Like.* Adverbial conjunction—'like rain falls from a cloud.'
198. *Passing, i.e.* surpassing or wonderful.
199. This line is a noun sentence in apposition with *it* in preceding line.
200. *Would* = wish. Principal verb (*not* Auxiliary) followed by a noun sentence.
To see. Infinitive of Purpose, gov., a noun sentence.
201. *So* — Adv. of Degree mod. *gloriously.*
202. Supply 'how it.'
203. *Far.* Adv. of Deg., mod. *aloof. Aloof* = Adj. of place qual. galleries.
205. *like.* Adv. Conj.—'like heaven's own light shines.'
207. Supply *it* at commencement of line, also as Subject in the two following lines.
211. *As.* Comp. Adv. modifying the Adverbial Sentence following.
Dav. Abs. Noun. Obj. Case.—The Adverbial Object (see Text Book).
213. *Some.* Adv. of Degree modifying 'seventy.'
Winters. Adverbial object.
Old. Adjectival completion of the Pred. *seemed.*
222. *All* = Entirely = Adv. modifying 'unruffled.'

'The Task.' General Paraphrase.

613-557. But there is another far-reaching and potent cause which is mainly responsible for this deterioration among the rural population, one which it is, I suppose, somewhat unpatriotic to wish to remove; that is, the drafting of the country labourers into the ranks of the army. The profession of arms, while satisfying the bloodthirsty and brutal instincts of all, seems particularly destructive of morality. When the country yokel, ignorant and simple, accustomed only to such innocent recreations as may be found in the wrestling matches, football, racing, or the merriment of a country fair, first hears that he has been selected by ballot to serve in the army, he receives the information with some amount of astonishment and awe. He presents himself shyly and awkwardly, takes off his hat and in indistinct tones mumbles through the oath, which, though he is ignorant of its purport, places him for a time at the complete disposal of his superiors. He is handed over to the drill sergeant, who forthwith commences a long series of lessons interspersed with jests and oaths at his awkward walk, turned-in toes, round shoulders, bent knees, and woebegone appearance.

Gradually, however, these blemishes, notwithstanding his natural density and dulness, are removed. He stands erect, his plodding step becomes an alert military stride, his whole appearance is improved, his hair is dressed with grease and covered with powder, his helmet or hat is worn with a swagger, and, conscious of and pleased at the change, he endeavours to improve still more, so that when at the termination of his service he returns to his native village, he looks with disdain upon the humble occupations he previously shared in, and regrets the loss of his boon companions of the regiment. For with the improvement in outward appearance there is a great deterioration in the whole moral tone of the man. His contented ignorance is replaced by the knowledge of dissolute vices, which he loves to parade. He is a drunkard and gambler, his speech is interlarded with oaths, he is a lazy and insolent rogue, and whereas he once was a useful member of society his chief aim seems now to act so as to break the heart of his mother and ruin the girl who formerly loved and trusted him.

B.—*Arithmetic.*

First Year.

Boys.—Fractions applied to quantities.

Girls.—Addition and Substraction of Fractions. Prepare diagrams to illustrate and prove the rules.

Second Year.

Boys.—General Problems on Stocks.

Girls.—Fractions applied to weights and measures.

Third Year.

Boys.—General Problems.

Girls.—Division into Proportional Parts. Note especially the method followed with fractions.

C.—*Music.*

First Year.—Two, three, and four-pulse measures.
Second Year.—General practice on transitions.
Third Year.—Finish the common musical terms.

D.—*Geography.*

Ireland.—Draw maps for each section of work, insert all places to be remembered, and practise continually till known. The industries and towns, railways, &c., require special attention. Any general reading which assists should be done.

Test Questions on Scotland.

1. Describe the situation and character of the Highlands.
2. Where are Lanark and the Trossachs? Give one or two leading facts about them.
3. Name three important rivers in Scotland, state where they rise, what important towns are on their banks, and what is the commercial importance of these towns.
4. Where are the following and for what noted?—Sumburgh Head, Stornoway, Berwick, Oban, Dundee, Aberdeen, Balmoral, Kyles of Bute, Crinan Canal, St. Andrews, Glenmore, Strathmore, Carse of Gowrie.
5. Explain clearly what is meant by the Hebrides. Make a list of them and give a description of the island of Arran.
6. Name places famous for the birth or residence of great men in the Lowlands.
7. Describe a coasting voyage from Edinburgh to Wick and from Oban to Glasgow.
8. Describe the Mountain and Hill system of Scotland.
9. Write a letter giving an account of a fortnight's holiday in the Western Highlands.
10. What are the chief industries of Scotland, and in what districts and towns are they carried on?
11. Say what you can of the climate of Scotland. What is meant by the statement that 'the isotherms follow the Meridians'?
12. Compare and contrast the Eastern and Western Coasts.
13. Give some account of the fishing industry round the Scotch Coasts.
14. What are the chief Railway lines of Scotland?
15. Which are the University towns of Scotland? What do you know of Education in Scotland generally?
16. Name some important battlefields in Scotland, and account if you can for the fact that battles were fought there.

E.—*History.*

William I.—Note carefully the results of the Conquest. The Feudal System and all terms connected with it. The subjugation of England, the various revolts against the Norman rule. Read Kingsley's 'Hereward the Wake.'

Note.—Changes produced by the Conquest.

1. New dynasty, or reigning family.
2. New nobility—many of very humble antecedents.
3. Saxon Commoners became villeins, Saxon lands tranferred to Normans.
4. England brought into closer contact with the Continent, France especially.
5. Perfection of Feudal System, which had existed before.
6. The Church much improved in learning, &c.—Numerous Cathedrals and Monasteries built. Saxon prelates displaced by Normans.
7. The Saxon laws give way to Norman-French law.
8. The language—Anglo-Saxon spoken by the poorer classes, Norman-French by new nobility—consequent strife for 200 years, resulting in the formation of *English.*
9. Change in dress, manners, and food.
10. The phlegmatic Saxon temperament improved by the infusion of the quicker Norman blood.

F.—*Euclid.*

Second Year.—Props. 17–20, with two deductions per week.
Third Year.—Revise Definitions, Axioms, Postulates, and Props. 1–6, Book I., and work four deductions per week.

G.—*Algebra.*

Complex fractions. Use factors as much as possible.

Remember the signs of the numerator *or* denominator may be changed if the sign preceding the fraction is changed, or signs in both numerator and denominator may be changed without changing sign in front.

H.—*Teaching.*

Second Year.—Chap. V. 'Scholarship School Management.' The Teaching of Spelling and Wordbuilding.

Third Year.—Chap. XIII. 'Scholarship School Management.' Discipline (First half). Meaning of term, exterior circumstances affecting it, &c.

QUESTIONS TO BE ANSWERED.

1. *Penmanship.*

(*a*) Largehand—Negligently, Ornithorhynchus, Parallelogram.

(*b*) Smallhand—

Alas! they had been friends in youth,
But whispering tongues can poison truth.

2. Write an essay each week.

(*a*) The results of the Norman Conquest.
(*b*) Divers and their work.
(*c*) A stitch in time saves nine.
(*d*) A walk in the country.

3. *English.—First Year.*

(1) Analyse Stanza XIV. and parse *him* (152) *to come*, (153) *ere evening close, would read, may not be said.*

(2) How do you distinguish Adverbs from Prepositions? Give examples where the same word may be used as both.

(3) Take the following words to pieces and tell the meaning of each of their parts:—Homeward, Oaken, Greenish, Friendless, Mirthful, Chicken, Kingdom, Songster, Duckling, Childhood, Forgive.

Second Year.

(1) Paraphrase 576–586; 595–612.

(2) Analyse 566–585; 578–586; 595–612.

(3) Parse *to invade* (560), *another's* (560), *their own* (560), *to frighten* (564), *farewell* (565), *even* (572), *unconscious once* (573), *full* (579), *luxury excess* (581), *contagious* (584), *themselves* (589), *herself* (593), *in vain* (596), *himself enslaved* (601), *prove* (604), *than becomes* (605), *whose* (610).

(4) Give the prefix, root, and suffix of the following words: —*unguarded, undisturbed, unsuspicious, unconscious, scrofulous, resident, magisterial, profession, propitious.*

Third Year.

1. Paraphrase

(*a*) Be not over-exquisite
. . . . . misbecoming plight,
(*b*) Virtue could see . . .
. . . . . dungeon.
(*c*) I do not, brother . . . you remember not.

2. Analyse the same passages.

3. Parse *grant* (361), *what need* (362), *so to seek* (366), *not being in danger* (370), *all to-ruffled* (380), *far* (388), *to save her blossoms* (396), *as well* (398), *rather than* (412).

4. *Arithmetic.—First Year.—Boys.*

1. Simplify

$$1\tfrac{1}{4} \times 12\tfrac{1}{5} \text{ of } \tfrac{2}{5} - \frac{6\tfrac{1}{2} + 7\tfrac{1}{10}}{12 - 6\tfrac{3}{4}} - \frac{4 + \cfrac{1}{4 + \cfrac{1}{4 - \frac{1}{4}}}}{4}$$

Ans. 2.

2. Simplify

$$1\tfrac{1}{3} \times \frac{\frac{3}{5} + \frac{1}{2}}{\frac{3}{5} - \frac{1}{2}} - 1\tfrac{3}{4} + \tfrac{5}{8} - 2\left(\tfrac{3}{8} - \tfrac{1}{12}\right).$$

Ans. 0.

3. Simplify

$$\left\{11\tfrac{3}{4} - 10\tfrac{1}{2} \div 10\tfrac{3}{8} + 11\tfrac{1}{8}\right\} \frac{2}{9} + \frac{3}{11}.$$
$$\left\{11\tfrac{1}{4} + 10\tfrac{1}{2} \div 10\tfrac{3}{8} - 9\tfrac{1}{8}\right\} \frac{8}{9} - \frac{1}{11}$$

Ans. $\frac{22}{132}$.

4. Simplify

$$\left[\tfrac{1}{6} \text{ of } \left(\tfrac{1}{10} - \tfrac{1}{11}\right) \div \tfrac{3}{5} - \tfrac{1}{8} \div \left(\tfrac{1}{6} + \tfrac{1}{11}\right) \div \left(\tfrac{1}{7} + \tfrac{1}{6}\right) \div \left(\tfrac{1}{6} - \tfrac{1}{11}\right)\right] \times \frac{\frac{1}{3} + 1 \div \left(1 - \frac{1}{2}\right)}{\left(\frac{1}{3} + 2\right) \div \frac{1}{2} - \frac{1}{6}}$$

Ans. 1.

Second Year.—Boys.

1. What is meant by 'stock'? If $3\frac{1}{2}$ per cent. stock is purchasable at $87\frac{1}{2}$, what annual income can I secure by investing £4,380 16s. 8d. in it after paying $\frac{1}{2}$ per cent. on the purchase money for brokerage? Ans. £174 19s. $8\frac{4}{10}$d.

2. What sum of money must be invested in the $5\frac{1}{2}$ per cent. stock at $83\frac{1}{3}$ to enable the possessor to realise an income of £64 3s. 4d. per calendar month? Ans. £11,620

3. If the 3 per cents. are at 93, what interest is obtained for money invested? Ans. $3\frac{7}{31}$ per cent.

4. Which of the following stocks is most profitable for investment—3 per cents. at $91\frac{1}{2}$, $3\frac{1}{2}$ per cents. at $108\frac{1}{2}$, 4 per cents. at 118? Find the income from investing £5217 16s. 3d. in the most advantageous of the three.

Ans. 4 p. c. at 118; £176 17s. 6d.

Second Year—Girls. (As First Year Boys.)

Third Year—Boys.

1. If 36 cwt. 3 qr. 23 lb. 7 oz. of iron be worth 209 yds. of calico, how many yards are worth 16 cwt. 3 qr. 5 lb. 9 oz. iron? Ans. 95 yds.

2. A ship was insured so as to cover the value of the ship and the premium paid. The premium of $4\frac{1}{2}$ per cent. on the amount insured amounted to £1,788 15s. What was the value of the ship? Ans. £37,961 5s.

3. Reduce 23 cwt. 1 qr. 7 lb. to the decimal of 56 cwt. 2 qr. 15 lb., and find the value of $3\ 8\tfrac{1}{3} \times$ £1 0s. $9\frac{3}{4}$d.

Ans. $\cdot 6\frac{1}{3}$; £4.

4. Show that division by $\frac{2}{3}$ is equivalent to multiplication by $\frac{3}{2}$ and division by $\frac{5}{8}$ is equivalent to multiplication by $\frac{8}{5}$.

Take the examples

$$12s. \div \tfrac{2}{3} = \tfrac{3}{2} \times 12s.$$
$$15s. \div \tfrac{5}{8} = \tfrac{8}{5} \times 15s.$$

Third Year—Girls.

1. In a ship a certain number of men receive 63s. a week, five times as many 42s. 6d., and fourteen times as many 17s. 6d. If £182 3s. 6d. be the weekly payment to all, find the number of men. Ans. 140.

2. Find the value of ·000416 ton + ·0512 of 1 cwt. 13 lbs.—·171 of 1 qr. 9 lbs. Ans. 1 lb.

3. Divide a profit of £355 among three partners whose capitals are £735, £840, and £910.

Ans. £105; £120; £130.

4. A cistern holding 800 gallons is filled by 3 pipes in 25 minutes. One pipe discharges 5 gallons more and the other 3 gallons less than the third per minute. How much flows through each per minute? Ans. 10, 15, 7 gallons.

5. *Music.—First Year.*—Name the intervals Te_1—*fah*, ray_1—*le*, *me*—*soh*, lah_1—d^1.

Second Year.—If the first note of each of the following passages is regarded as *me*, what will the others become?

(*a*) **t r fe s l fe l t m fe s**
(*b*) **l f ta s d' l ta r d ta$_1$ l$_1$**

Third Year.—Explain triplet, da capo, larghetto, staccato, cantabile, calando, sforzando.

6. Describe, with a sketch map, the basin of the Clyde.

7. Describe, with a plan, the Battle of Hastings.

8. Give some account of the Saxon laws.

9. What was the Witanagemote—what were its powers?

10. What preparation would you make before giving a reading lesson? What are the chief desirable qualities in a reading book? How would you encourage home reading?

11. Describe some system of drill which would be suitable to junior classes.

12. Write notes of lessons on the following subjects: A Court of justice, a Farmhouse, Building a house.

ANSWERS TO ARITHMETIC TEST EXAMINATION.

First Year.—Boys.

(1) 1; (2) 3·765, $3\frac{153}{200}$; (3) 35 days; (4) £5 10s. 3d., £3 8s. 3d., £1 2s. 9d.; (5) 52,502.

Girls.

(1) See Text Book; (2) £3 4s. $1\frac{3}{8}$d.; (3) £112 7s. 6d.; (4) $64\frac{3}{4}\frac{2}{1}$; (5) 1,536 and 4 lbs. over.

Second Year.—Boys.

(1) £2; (2) $91\frac{1}{2}$; (3) £280 4s. $2\frac{2}{3}$d.; (4) £100; (5) $117\frac{1}{2}\frac{5}{5}$.

Girls.

(1) Text Book; (2) $\frac{1}{4}$; (3) 6·19; (4) £257 2s. $2\frac{1}{2}$d.; (5) $21\frac{3}{7}$ days.

Third Year.—Boys.

(1) 23,461·75; (2) £9 9s. $0\frac{7533}{3000}$d., £217 4s. $0\frac{7533}{8000}$d.; (3) $8\frac{5}{1}\frac{2}{2}\frac{5}{5}$; (4) loss in capital £141 5s., gain £1 0s. $7\frac{1}{2}$d.; (5) £481 17s. 6d.

Girls.

(1) 8s.; (2) £98 0s. 84d., £122, £145 19s. $3\frac{3}{4}$d.; (3) 7 A, 1 B; (4) 2 ac. 2 rd. 22 pls.; (5) $\frac{12}{165}$.

SCHOLARSHIP COURSE FOR DECEMBER 1897.

10TH MONTH—OCTOBER 1897.

1. *Reading.* } Ten minutes' practice at each daily.
2. *Writing.* }

The necessity of paying great attention to the penmanship cannot be too often impressed upon students. From the specimens submitted it is evident that many take altogether too low a standard of what is required, and many marks—every one of which is valuable—are lost through inattention to little points which every teacher should be perfectly familiar with. A good model is essential.

3. *Spelling.*—50 words per week from 'Words Commonly Misspelt,' or any good list. Test regularly by dictation.

4. *Composition.*—Write one or two essays each week, selecting from the following :—

(1) 'Words are like leaves, and when they most abound
Much sense of fruit beneath is rarely found.'
(2) Our educational system.
(3) How far is it true that history is the biography of great men?
(4) Strikes.
(5) Dress as an evidence of character.
(6) 'He that hath wife and children hath given hostages to fortune.'
(7) Habit.
(8) Distinction between Art and Science.

Too much care and attention cannot be given to this subject. Read up from any source all the information you can. Plan out the essay, dividing the matter into sections, and marking the commencement of each by beginning a fresh paragraph. The chief essential is of course clearness and lucidity of statement. The writing should be as vigorous as possible.

5. *English.*—

1. 25 roots and meanings per week.
2. Analysis and parsing. Revise all terms connected with these. Make quite sure of the relation of sentences—kinds of subordinate—what may form the subject or object of a sentence.
3. Meiklejohn's 'English Literature,' Chap. IX. Longfellow, Tennyson, the Brownings, William Morris, Matthew Arnold, Thackeray, Dickens, George Eliot, and Ruskin.
4. The influence of the Revival of Learning upon English Literature.

6. *Arithmetic.*—Problems relating to Mixtures, Watch and Clock sums, Time and Rate, Mixed Agents.

THE METRIC SYSTEM.

The formation of the Metric System is due to the zeal of the French reformers of 1795, who, anxious to get rid of everything associated with the past, devised a new and most sensible and easy system of weights and measures.

One ten-millionth part of a quarter of the earth's polar circumference was obtained as nearly as possible by triangulation. This was called the Metre (Greek, *metron* = a measure). It was sub-divided by tens and multiplied by tens for other measures, so that the table of measurement is :—

10 millimetres = 1 centimetre.
10 centimeteres = 1 decimetre.
10 decimetres = 1 metre.
10 metres = 1 decametre.
10 decametres = 1 hectometre.
10 hectometres = 1 kilometre.
10 kilometres = 1 myriametre.

It will be observed that the Latin prefixes *milli, centi, deci* are used for subdivisions, and the Greek prefixes *deca, hecto, kilo, myria* are used for multiples. This is adopted in all other measures and weights.

The following table shows the chief points to be learnt :—

Table.	Unit.	English Equivalent.	How Obtained.
Length	Metre	39·37·8 inches	$\frac{1}{10000000}$ part of ¼ of earth's polar circumference.
Area	Are	1076·429 sq. ft.	100 square metres.
Capacity	Litre	1·76 pints	Cubic Decimetre.
Solidity	Stere	35·3165 cu. ft.	Cubic Metre.
Weight	Gramme	·032 oz. (Troy)	The weight of a Cubic Centimetre of water at a given temperature.

The advantages of such a system are obvious. There are no compound rules, reduction may be done at sight. *E.g.*, Reduce 7 kilometres 6 hectometres 7 decametres 3 metres 7 decimetres 8 centimetres 9 millimetres to millimetres = 7673789, to metres = 7673·789, to centimetres = 767378·9, etc. Or, to take another example in weight, multiply 1 kilogramme 7 hectogrammes 8 decagrammes 5 grammes 8 decigrammes by 121. This = 17858 decigrammes × 121 = 2160818 decigrammes = 216 kilog. 0 hektog. 8 decag. 1 gr. 8 decig.

Another example :—7 hectolitres 3 decalitres 5 litres 3 decilitres 8 centilitres @ 12 francs 75 centimes per litre. The amount equals 735·38 litres and the money 12·75 francs. Multiply by ordinary multiplication = 9376·0950. That is 9376 francs 9·5 centimes.

The adoption of such a system in England would be a great boon, although it might cause some little difficulty at first. A decimal system of coinage advocated for England is 10 mils = 1 cent, 10 cents = 1 florin, 10 florins = £1. Thus a *cent* or hundredth part of a £ would be about 2⅓*d.*, a mil about ¼*d.*, a 5 mil piece would do duty for a penny, and a 5 cent piece for a shilling.

It would be advisable to work a few examp'es in these weights and measures till thoroughly known.

Girls.—Algebra. Problems leading to Simple Equations.

Boys.—Mensuration of the Circle.

7. *Algebra.*—Hall & Knight, Chapter XXX. Indices. Note particularly the Theory of Indices and the proof of the facts:—

$$a^m \times a^n = a^{m+n}\ ;\ a^m \div a^n = a^{m-n}\ ;\ a = 1.$$

8. *Euclid.*—Book I. Revise 1–26. Deductions. Egan's Exercises, 200–230.

9. *Geography.*—

(*a*) The geography of Ireland fully.
(*b*) General revision of Europe.

All students would do well also to read up the Physical Geography—Winds, Tides, Currents, Climate and how affected.

10. *History.*—George II. Chief points :—

Walpole's administration.
The Excise Scheme.
War of the Austrian succession—Pragmatic Sanction.
Dettingen and Fontenoy.
The Rebellion of '45 : its causes and results.
Peace of Aix la Chapelle.
Reformation of Calendar.

The necessity for this reformation becomes apparent when we consider that under the Julian Calendar the year was reckoned as 365¼ days instead of 365 days 5 hours 48 minutes 46 seconds—that is about 11 minutes too long. This made a difference of a day in about 130 years; so that England had by reckoning the year too long fallen 11 days behind the true time, as shown by the sun. These 11 days were omitted by law, and the year started from January 1 instead of March 25 as previously.

To prevent a similar error in the future it was decided to drop 3 days every 400 years, these days being the extra Leap Year days, due in the centuries 1800, 1900, &c. (excepting the centuries where the first two figures are divisible by 4). By this means the error will not amount to a day under some thousands of years.

The Seven Years' War.—Caused by :

(*a*) French alarm at growth of Prussia.
(*b*) Desire of Austria to recover Silesia.
(*c*) English anxiety for Hanover.
(*d*) Rivalry of France and England
(1) in North America,
(2) in India.

Note 1759, 'The most glorious year that England has ever seen.'

Capture of Quebec, which secured Canada.

Battle of Plassey (1757) laid the foundation of our Indian Empire.

11. *Teaching.*—'Scholarship School Management,' Chap. X.

12. *Domestic Economy.*—Revise Clothing and Washing.

13. *Music.*—'School Music Teacher,' Chap. X.

14. *French.*—Finish 'La Grammaire.'

TEST QUESTIONS.

1. *Penmanship.*

(*a*) Largehand :—
Surajah Dowlah.
(*b*) Smallhand :—
Here about the beach I wandered nourishing a youth sublime.

2. Analyse the following, and parse the words in italics:—

(*a*) And is *this*—*}arrow?* *This* the stream
Of which my fancy cherished,
So faithfully, a waking dream,
An *image* that hath perished?
O *that* some minstrel's harp were near
To utter notes of gladness,
And chase this *silence* from the air
That fills my soul with sadness.

(*b*) I do remember *me*, that in my youth
When I was wandering, upon *such* a night
I stood within the Colisæum's wall,
Midst the chief relics of almighty Rome;
And thou didst shine, *thou* rolling moon, upon
All this, and cast a wide and tender light

Which softened *down* the hoar austerity
Of rugged desolation, and filled up,
As 'twere anew, the gaps of centuries ;
Leaving *that beautiful* which still was *so*,
And making that which was not.

(*c*) The forms of English law, *however inadequate* to defend the subject in State prosecutions, imposed a degree of *seeming* restraint on the Crown, and wounded that pride which is commonly a yet stronger sentiment *than* the *lust* of power with princes and their counsellors. *It* was possible that juries *might absolve* a prisoner ; it was always necessary that they should be the arbiters of his fate. Delays, *too*, were interposed by the regular process, *but not such, perhaps, as* the life of man would require, *yet enough* to weaken the terrors of summary punishment.

(*d*) In barbarous or semi-civilised societies, *such as* are found in Europe in the Middle Ages, the social organism is *very simple ;* division of labour or class *can hardly be said to exist.* Society is bisected. You only see two classes, nobles and peasantry, lords and serfs, producers and unproductive consumers —*the wholly idle* and the *severely worked*. Gradually with the progress of civilisation, society became composed of more heterogeneous elements, and life assumed a rich and attractive appearance, bright with a thousand varying hues.

3. Say what you can of Carlyle, his work and influence.

4. Give examples of each of the following, and some rules for its right use :—

The nominative absolute.
The subjunctive mood.
The gerundial infinitive.
The double negative.

5. *Dictation.*—Others, again, in order to palliate a crime, state the most mendacious falsehoods with the greatest possible effrontery, and try to corroborate their primary misstatements with others equally unreliable. It follows as a corollary from this perseverance in untruthfulness that the impeachment of the veracity of a liar, like the impeachment of the honesty of a rogue, is almost invariably requited with the most malignant resentment. An honest man can afford to smile at an allegation of dishonesty, and to treat such an accusation with contempt. In like manner, a man of truth, to whom untruth is imputed, can bear such an accusation with tranquillity, and treat it with indifference. But it is galling to be so accused or so treated, and people should avoid the customary or even incidental use of phraseology calculated to irritate their neighbours in the smallest degree. Some people are very unscrupulous through mistaken ideas of candour in attributing wanton inaccuracy, but their ignorant impropriety is almost as blamable for their gross incivility of demeanour.

6. *Arithmetic*—

(1.) What is the G.C.M. of £36 0s. 4½d., £48 14s. 7½d., and £85 17s. 4½d.? Ans. £2 2s 4½d.

(2.) After spending ½ of ⅔ of ¼ of the money in my purse, I find that I have just enough left to buy 9⅔ dozen eggs at the rate of 4 for 3d. How much had I at first? Ans. 8s. 9d.

(3.) A walks at the rate of 4 miles an hour, and goes a certain distance in 30 minutes less than B, who walks the same distance at the rate of 3 miles an hour ; what is the distance? Ans. 6 miles.

(4.) The surface of a chessboard is taken up by a rim 1½ inches wide, running along each of the four sides, and by 64 equal squares. If the side of one of these squares is 2 inches long, find the area of the rim. Ans. 105 square inches.

(5.) If the ratio of the circumference of a circle to its diameter be as 355 to 113, how many times will a carriage wheel, whose diameter is 4 feet, revolve in a distance of 4 miles 1,480 yards? Ans. 2,034.

(6.) If 3 articles are sold for the cost price of 4, what is the rate of gain per cent.? Ans. 33⅓ per cent.

(7.) Having invested equal sums in a 4 per cent. stock at 85, and a 5 per cent. stock at 95, I find that the difference in the income from the two investments amounts to £260. How much did I invest in each stock? Ans. £46,655 11s. 1⅓d.

7. Give some account of the social condition of the people in the seventeenth century.

8. What do you know of the South Sea Bubble?

9. Say what you can of the state of literature in the reign of William III.

10. State what you know of the position, the people, and the history of San Francisco, New Orleans, Buenos Ayres, Cape Town, Hong Kong, Port Said, Constantinople.

11. Describe the situation, and account for the rapid growth of the following places : Crewe, Swindon, Barrow-in-Furness, Middlesbro', Bournemouth, Blackpool.

12. What preparation have you been taught to use before letting children attempt to work sums in weights and measures?

13. (*a*) How would you define *food?* Upon what properties do the nutritious qualities of the following articles of food depend :—bread, potatoes, fish, bacon, jelly, butter?

(*b*) Describe the various ways in which eggs may be used in cooking.

(*c*) What precaution will you take to secure pure milk? How may it be kept from turning sour? Show that milk is rightly termed a model food for young children.

Revision Questions in Music.

Tonic Sol-fa Notation.

1. Write the following values in Four-pulse measure :—

¼	¾	¼	1½	½	½	1	etc.
s,	f,	t_1,	d,	r,	m,	rest,	etc. (1893.)

2. Write in figures over each note and rest in the following passage its value in pulses, or fractions of a pulse :—Three-pulse measure (1893), Two-pulse (1892).

3. Re-write passages, doubling the value of each note and rest :—Two-pulse. (1892), (1891), (1890), (1889), (1888), (1887), (1886), (1885), (1884), (1883).

4. Re-write passages, halving the value of each note and rest :—Two-pulse. (1892 to 1883.)

5. Write the pulse signs for four different kinds of measure. (1891.)

6. Write the pulse signs for Two-, Three-, Four-, Six-pulse measure. (1890), (1889), (1886), (1885), (1884), (1883), (1882), (1881).

7. Describe the measures formed by the following accents :—Secondary Two-pulse, Primary Three-pulse, Primary Six-pulse (1888), Primary Four-pulse, Tertiary Three-pulse, Secondary Two-pulse (1887).

8. Describe the intervals formed by the following pairs of notes:—

| | | | | | | |

Questions for Revision in Geography.

(Selected from Department Examinations.)

1. Describe the position of Belgrade, Cadiz, Copenhagen, Ancona, Rouen, Dresden, and Warsaw. Name some historical associations connected with three of them.

2. Describe two of the great mountain ranges of India, and name the rivers which rise in or break through them.

3. Say what you can of the productions of Ceylon.

4. Name some of the principal animals, trees, and fruits, which are not found in England, but are to be met with in India or Australia.

5. Name some of the famous buildings in Europe. State their locality, and why they are famous.

6. Describe a journey from London to St. Petersburg, *or* Madrid, *or* Constantinople, and say what interesting places or scenes worthy of a visit are in or near the towns you have selected.

7. Describe the position as accurately as you can, and say what you know of each of the following:—Bangalore, Cracow, Innsbruck, Rangoon, Trincomalee, Varna, Valetta.

8. Mention the principal rivers flowing into the North and Baltic Seas; say where they rise, and what important towns are situated on their banks.

9. Explain clearly how India is governed. Name the provinces and the chief towns of each.

10. Describe the positions of Rome, Agra, Seville, Belgrade, Lahore, Calicut, and Dresden.

11. What are the chief productions of Assam, Lombardy, and Holland.

12. Where are these places to be found?—Delhi, Kurrachee, Colombo, Cadiz, Adrianople, Heligoland, Munich, Florence, Simla, and Lucknow.

13. Name the chief races of men inhabiting Europe, and give their distribution and distinguishing characteristics.

14. Where are the following, and for what noted?—Dresden, Nijni Novgorod, Florence, Munich, Liège, Bergen, Hamburg, Bucharest, Brindisi, Palermo, Patna.

15. Describe the valley of the Ganges.

16. Show what political and what climatical influences any of the mountain ranges of Europe and Asia have had upon adjacent countries.

17. Where are the following, and for what noted?—Adrianople, Goa, Belgrade, Corfu, Cordova, Colombo, Sofia, Pondicherry, Cettinge.

18. Say what you know of the causes, effects, and times of the Monsoons in Northern and Southern Hindustan, respectively.

19. Name the chief European centres for wine, wheat, olives, oranges, silk weaving, horse breeding, tobacco, timber, tallow, and steel.

20. What are the chief industries of the south of France, the north of Russia, and of Sweden?

21. State what you know about the Dutch people and their language. Name the chief cities of Holland.

22. Contrast the life and surroundings of a Laplander with those of a Dutch peasant.

23. What is the area and population of India? Mention some of the different races found in it. From what parts of India do the Sikhs, Ghoorkas, and Mahrattas come?

24. Write four or five lines about *four* of the following—Laccadives, Landes, Sunderbunds, Isthmus of Corinth, Crimea, Darjeeling, and Finland.

25. From what parts of Europe or Asia do we obtain—attar of roses, sulphur, toys, copper, currants, pearls, furs, bulbs, tea and coffee?

26. Give a description of three of the following—Siberia, Afghanistan, the Red Sea, Corea.

27. Name the chief mountain systems of Asia, and give a description of one of them.

28. Where and what are Ava, Balkash, Tonquin, Singapore, Manilla, Krakatoa, and Formosa?

29. Name four of the chief rivers in Asia, their sources, the chief towns on their banks, and the sort of produce which is carried by means of them.

30. What Asiatic rivers flow into—(*a*) Sea of Aral, (*b*) Persian Gulf, (*c*) Arctic Ocean?

31. Give some account of the commercial and political position of Afghanistan and Japan.

32. Give a full account of the Persian Empire, the States by which it is bounded, the chief industries, the religion of its people.

33. Where are Ispahan, Smyrna, Agra, Merv, Tokio, Hong Kong, Herat, Yokohama, and Fusiyama?

34. Give some account of the river systems, climate, and products of Siberia, or of the Chinese Empire.

35. Say what you know of the Indo-Chinese Peninsula, especially of the Straits Settlements.

36. Describe a coasting voyage from Rangoon to Pekin.

37. Where and what are the following?—Hoang-ho, Amoy, Corea, Samarcand, Amur, Manipur, Everest, Persepolis, Dooab.

38. 'Asia throws out large offshoots on two of its sides; the gulfs which penetrate it are all the more valuable for commerce, inasmuch as great rivers flow into them.' Give as many instances as you can which will prove the above statements, and show that they prove them.

39. Give the exact position, and say what you know of the Tundra, Vladivostock, Goa, Kandy, Darjeeling, Aleppo, Yemen, Khelat.

40. What is known respecting the size and population of China? Give the names and position of its six largest towns, and say what you can of each.

41. Give some account of the government and social life of Japan. Name the countries in Asia which are—

(*a*) Under the rule of the Empress of India.
(*b*) ,, ,, ,, Czar of Russia.
(*c*) ,, ,, ,, Sultan of Turkey.

Selected Questions in History.

1. Name, with dates, the chief events of the reign of Henry VI.

2. What do you know of Drake, Spenser, Cranmer, Somerset (Protector), and Raleigh?

3. Give, with dates, the chief events of the period 1340–1400.

4. What had England to do with Spain in the reigns of Edward III., Henry VII., and Mary?

5. Describe the relations between England and Scotland in the reigns of Henry VIII., Edward VI., and Elizabeth.

6. What connection do you trace between the Black Death, the Statute of Labourers, and Wat Tyler's Rebellion?

7. What claim did Henry VII. prefer to the throne? What difficulties did he have to contend against? With what purpose did he establish the Star Chamber?

8. What was the policy of Elizabeth with respect to religion? Who were the Puritans? Point out clearly in what way the presence of Mary Queen of Scots in England was a danger to the peace of the kingdom.

9. What claims did Edward III. and Henry V. put forward to the French crown, and how did their immediate successors maintain them?

10. Say briefly how armies, ships, and money were raised under the Plantagenets.

11. Sketch the gradual decline of the English power in France after the death of Henry V.

12. What do you know about the 'Good Parliament'? Show that its name was an appropriate one.

13. What led to Henry IV. coming to the throne? Was it a good thing for the country?

14. Mention the chief battles of the Wars of the Roses, and say what were the effects of these wars.

15. Who were the parents of James I.? Trace genealogically his title to the English throne.

16. Point out the strong and weak points in the character of Charles I., and illustrate your answer by events in his reign.

17. Give a short account of the chief ministers in the reigns of Henry VII., VIII., and Elizabeth (not including Cardinal Wolsey).

18. Show how the influence of the Court of France was exerted in the reigns of the later Stuarts, and with what result.

19. The Petition of Rights, the Grand Remonstrance, the Self-Denying Ordinance. Give the history of each of these.

20. Explain the terms:—Benevolences, Star Chamber, Ship Money, Exchequer, Legate, and Cardinal.

21. What do we hear of the Dutch in the time of Elizabeth, of Cromwell, and of Charles II.?

22. Compare the characters of Charles I. and Charles II., and account shortly for the troubles of the one reign and the comparatively peaceful character of the other.

23. Construct a table showing the relationship either between Elizabeth and Mary Queen of Scots, or between James I. and William III.

24. How did Henry VIII. come to take part in Continental wars, and with what result?

25. Thomas Cromwell, Arabella Stuart, Anne Hyde, Regent Murray, Cardinal Pole, Marquis of Montrose. Say all you can about any four of these.

26. What industries do we owe to foreign immigrants, and what can you tell of the causes which made these foreigners leave their own country?

27. Who were some of the great sailors under the Tudor Sovereign? Describe the objects and results of their voyages.

28. What was the Navigation Act, and what results had it?

29. Where are Marston Moor, Edgehill, and Newbury, and what importance had the battles that bear these names?

30. How was the Dissolution of the Monasteries accomplished? Give particulars of any resistance that took place.

31. Give a short life of Shakespeare or Milton.

32. How might the greatness and weakness of Elizabeth be illustrated from events in her history?

33. Contrast the grievances of the nation under Charles I. and James II.

34. The Declaration of Indulgence, the Declaration of Rights, the Declaration of Breda. What do you know of these?

35. Henry VII. initiated the home and foreign policy of the Tudors. Can you explain this and illustrate it by examples?

36. What revolts took place in Edward's VI.'s reign? What brought them about?

37. What led to the passing of the Poor Law Act of Elizabeth? State its main provisions.

38. Give an account of the foreign relations of England under Cromwell.

39. What were the chief events in Ireland in the reign of Charles I. and in the Commonwealth?

40. What were the chief causes that led to the dethronement of James the Second?

41. What was 'The Plantation of Ulster'? When was it effected, and how has it affected Ireland for good or ill?

RULES AS USUAL.

ANSWERS TO CORRESPONDENTS.

I. S. E. (Diss).—Analysis correct, 30/30. Parsing, 25/30. *Itself* = reflexive, not emphatic. Essay, 45/60, not enough original thought. Penmanship, 48/60. Small hand too large, down-strokes uneven in thickness.

E. J. M.—Failure to obtain 25 per cent. of marks in any of the subjects in Section A of the syllabus means a total failure. I should say 25 or 30 marks for second Drawing.

A. C. P.—Essay, 50/60.

F. J. H.—Essay, 48/60. Too much history—not enough original thought.

T. P. P.—Penmanship, 50/60.

I. *a* and *b* should be found in any text-book.
II. No.
III. Try Eyre & Spottiswoode's. I do not know anywhere else.
IV. *each*. Distributive pronoun, nominative absolute.
laid. Perfect passive participle, qualifying 'each.'

W. A. F.—Essay, 55/60. Penmanship, 50/60. General writing too loose and irregular.

L. G. P.—Essay, 55/60. Too long for examination purposes. Requires condensing.

DESIRÉE.—Essay, 58/60. Very good.

E. G.—Collar and Christian's 'Arithmetic' (Holden & Co.).

ADELINE.—Penmanship 55/60.

THISTLE.—40/60. You require practice from a good model; the writing is about right for size, but too coarse and thick. Your query is answered above.

BEULAH.—Essay, 55/60. A very good piece of composition.

ALL OTHER CORRESPONDENTS BY POST.

OUR 1898 CERTIFICATE CLASS.

BY J. C. HOROBIN, M.A.,
Principal, Cavendish College, Cambridge.

The Examination for Certificates will commence on Monday, 11th July 1898, at 2 p.m.

The general conditions for candidates are to be found in Articles 55–64 and 116–121 of the current Code.

NOTES ON 'MIDSUMMER NIGHT'S DREAM.'

This is the first play with an Epilogue.

The play may be compared with the 'Tempest' for the introduction of fairies; but in this play, contrary to the 'Tempest,' the mortals are the sport of the fairies.

In the wood scenes there is a comedy of errors with three sets of people as in the 'Comedy of Errors,' whilst in 'Love's Labour Lost' there are four sets of people.

Lysander and Demetrius are impatient and revengeful whilst their love is being crossed; Hermia is vain and spiteful; Helena affectionate and dignified, but slightly malicious; Theseus is a courteous gentleman; the fairies, though delicate and aerial, have just enough vulgarity not to be in too great contrast with the other characters.

The play was in existence in 1598, but it may have been written in 1594 or 1592.

QUESTIONS FOR TESTS.

FIRST YEAR.

Penmanship.

Write in text hand and small hand:—

'Negotiating is the preliminary to action.'
Democratic imperialism.

Spelling.

Write from dictation:—

The winning of honour | is but the revealing of man's virtue and worth | without disadvantage. | For some in their actions | do woo and affect honour and reputation, | which sort of men | are commonly much talked of | but inwardly little admired. | And some, | contrariwise, | darken their virtue in the show of it; | so as they be undervalued in opinion. | If a man perform that which hath not been attempted before, | or attempted and given over, | or hath been achieved, | but not with so good circumstances, | he shall purchase more honour | than by effecting a matter of greater difficulty or virtue | wherein he is but a follower. If a man so temper his actions, | as in some one of them he doth content | every faction or combination of people, | the music will be the fuller. A man is an ill husband of his honour | that entereth into any action | the failing wherein | may disgrace him more | than the carrying of it through can honour him.

School Management.

1. What are the characteristics of good reading?

2. Compare the alphabetic, phonic, and look-and-say methods.

3. Draw up notes for a pupil teacher on the method of giving a dictation lesson.

Composition.

Write an essay on your idea of a good private and of a good public library.

Arithmetic.

1. Explain, showing the advantages (with an example), the method of complementary addition in teaching subtraction.

2. Prove x times y equals y times x.

3. What is the largest sum of money which can be paid an exact number of times out of £1 1s. 7d. and £2 6s. 3d.

4. Simplify $\{10 + [8 - (9 - 3)]\} - 5$.

5. Simplify $\dfrac{\frac{3}{4} \div 2\frac{1}{2}}{1\frac{1}{5} \div 2\frac{3}{4}}$.

6. Express £4 5s. 7d. as a fraction of £18 2s. 1d.

7. A traveller has gone $\frac{1}{6}$ of a journey on foot, $\frac{2}{5}$ on horseback, $\frac{1}{4}$ by rail, and the rest by coach; what part has he gone by coach?

8. Express $\cdot 3\dot{7}$ as a vulgar fraction.

9. What income will be obtained by investing £3,400 in 3½ per cent. stock selling at £85?

10. If a train, A, 90 yards long, moving at the rate of 40 miles an hour, pass a train, B, 86 yards long, moving at the rate of 35 miles an hour, how long will it take A to pass B; (*a*) when they are moving in the same direction; (*b*) when they are moving in opposite directions?

Music.

1. Write against each of the following intervals its name (*e.g.*, major third, etc.):—(*a*) *ma* to *de*^{1}, (*b*) *fah* to *se*, (*c*) *ta* to *soh*^{1}, (*d*) *fe* to *ma*^{1}.

2. What is the name (*a*) for *ray* sharp, (*b*) for *te* flat, (*c*) for *soh* sharp? (*d*) State what the singer is told to do at $^{d}s_{1}$ in the following passage :—

Key C. f. F

s l r m $^{d}s_{1}$ l$_{1}$ t$_{1}$ r d

3. Write an ear test for Division II.

4. State the meanings of the following terms :—(1) *Fortissimo*, (2) *Da Capo*, (3) *Ad libitum*, (4) ♩ = M. 100.

English.

1. Parse fully the following words from 'Tintern Abbey' :—

Line	Line
9—is come.	67—like a roe.
19—might seem.	73—pleasures.
31—such.	74—movements.
32—as.	92—power.
45—sleep.	93—Chasten, subdue.
46—soul.	111—being.
56—Wye, wanderer.	119—while.
65—dare to hope.	

2. Distinguish between an inflection and a suffix, illustrating your answer.

3. Write the Possessive Case Plural number of woman, ox, mouse, child, and son-in-law. When a singular noun ends in an *s* sound, how is the possessive sign affected? Give examples.

Geography.

1. Draw a sketch map of Europe showing the direction of the main mountain chains with their names.

2. 'The larger volume of river water in Europe flows to the N. and S.E.' Discuss this statement fully and explain.

3. Where are, and what do you know about, Nice, Athens, Boulogne, Ostend, Homburg, Hamerfest, Riviera, Tyrol?

History.

1. What do you know of Pitt, Nelson, Cromwell?

2. Enumerate the causes of the Great Revolution and the principal events in it.

3. Give an account of Wilkes and the sequence of events which led to the loss of the American colonies.

Algebra.

1. Find the value of :—

$$\frac{\sqrt{m+n}+\sqrt{m-n}}{\sqrt{m+n}-\sqrt{m-n}}, \text{ when } n=\frac{2mp}{p^2+1}$$

2. Multiply

$$a^{\frac{1}{3}}+4ab^{\frac{1}{3}}+12a^{\frac{2}{3}}b^{\frac{1}{3}}+16a^{\frac{1}{3}}b^{\frac{1}{3}}+16b^{\frac{2}{3}} \text{ by } a^{\frac{2}{3}}-4a^{\frac{1}{3}}b^{\frac{1}{3}}+4b^{\frac{2}{3}}.$$

3. Prove that the L.C.M. of any two algebraical expressions is found by dividing one of the expressions by their greatest common measure, and multiplying the quotient by the other expressions.

Geometry.

1. Prove I. 4.

2. If two triangles on opposite sides of the same base have the two sides equal which are terminated in one extremity of the base, and likewise those equal which are terminated in the other extremity of the base, the two triangles are equal in all respects. To be proved without using I. 8.

3. Prove II. 1.

4. Prove that if two adjacent angles be bisected the bisected lines contain a right angle.

SECOND YEAR.

School Management.

1. What facts should be recorded in the Admission Register, and in what circumstances may a name be removed from it, or be inserted in it a second time?

2. Describe what appear to you to be the wisest and most effectual ways of dealing with disobedience or other misconduct (*a*) in an infants' school, or (*b*) in a school for older children.

3. What divisions are usually made in discussing mental activity? Compare grammatical and logical terms.

Composition.

As First Year.

Music.

As First Year. Also :—

1. Re-write the following, doubling the value of each note and rest (*i.e.*, write in two pulses what is here given in one pulse) :—

| s :-.s,f | m.,r :d.t$_{1}$ | d .r :m | r,m.f:m . ‖

2. What measures are shown by the following?—

(*a*) | .s:l .,t | s :-.f | m.,f:s | d | :- }

(*b*) :s | m.,f : r : s | - :l .,t : d^{1} | t : m }

(*c*) | m:-.f : s | l :-.s:f | m: - :r | d : - : - }

English.

As First Year. Also :—

1. Write an outline of the play of M. N. D.

2. Discuss the reality or assumedness of Hamlet's madness.

Geography, History, As First Year.

Algebra.

As First Year. Also :—

1. Solve the equations :

(*a*) $\frac{4x-3}{2}-\frac{5x-4}{3}=\frac{6x-5}{4}-\frac{1}{12}$.

(*b*) $(x-3)(x-4)(x+12)=x^3$.

(*c*) $\frac{x}{2}+\frac{2}{y}=\frac{5}{4}$, $\frac{x}{3}+\frac{3}{y}=\frac{5}{3}$.

2. Find the sum of a number of terms in A.P., having given first term, common difference, and the number of terms.

If a, b, c, be in H.P., then the H.M. between a and b, and the H.M. between b and c will also be in H.P.

3. A bag contains sovereigns and shillings. If the number of sovereigns is doubled, the contents of the bag will be worth £21, but if the number of shillings is doubled the contents will be worth only £12. Find how many coins of each kind are in the bag.

Geometry.

As First Year. Also :—

1. Prove III. 4.

2. Prove III. 12.

Describe a circle of given radius that shall touch two given circles.

WOMEN ONLY.

Needlework.

First Year: Draw a diagram of the upper half of a woman's chemise, and cut out in paper and tack together the same

Second Year: Same as First Year for a boy's shirt.

Domestic Economy.

First Year: Draw a diagram of the circulatory system.

Second Year: What are the usual symptoms of sickening for mumps, measles, whooping cough, smallpox?

or

Geometry.

First and Second Year: Define circle, superfices, parallelogram, isosceles triangle, and write out axioms, 1, 3, and 5.

SYLLABUS OF WORK.

As a rule Saturday should be kept for writing out to time and without books or other aids the answers to the questions set, and for the practice in Penmanship and Composition.

Students are advised not only to get up the work indicated, but to use the questions as indexes as well as tests.

FIRST YEAR.

School Management.

1. Drill—uses, etc.
2. Museums—uses, etc.
3. Teaching first four rules of Arithmetic.
4. Gifts I–IV.

Composition.

1. Historical growth of English language.
2. Botany as a subject for children.
3. Use and dangers of Colonies.
4. Bimetallism.

Arithmetic.

Not less than six examples from miscellaneous sets ought to be worked per week, as well as those on the particular work set and the examination questions given.

1. Par. 35, 36, 36*, 44–46 P.
   Simple Interest.
2. Pars. 49–58 P.
   Discount.
3. Pars. 72–75 P.
   Discount.
4. Pars. 97, 98, 104–106 P.
   Practical Discount.

Music.

1. First and Second Step.
2. Mental effects.
3. Chordal Teaching.
4. Revise (1–3).

English.

N.B.—Macmillans have published a little book called 'Helps to the Study of Arnold's Wordsworth,' which will be found useful.

1. Case.
2. Number.
3. Anapaest, Dactyl, Amphibrach, Iambic verse.
4. Revise Figures of Speech.

(1.) Wordsworth—Power of Music.
Simon Lee.
Pillar of Trajan.

(2.) Elia—Introduction.
South Sea House.
Oxford in the Vacation.

Geography.

1. France, Physical.
2. Scandinavia, Physical.
3. France, Political, etc.
4. Revise.

History.

1. Reformation.
2. Barons War.
3. Tyler, Ket, Cade, Monmouth.
4. Blake, Wellington, Simon de Montfort.

Algebra.

1. Multiplication.
   Arithmetic Progression.
2. Division.
   Arithmetic Progression.
3. Factors.
   Arithmetic Progression.
4. Proof of
   (*a*) $ab = ba$.
   (*b*) $(-) \times (-) = +$.

Geometry.

1. Props. IV.–X. in I.
   ,, V., Book II.
2. ,, XI.–XII. in I. Revise 4 and 8.
   ,, VI., Book II.
3. ,, XIII.–XVI. in I. ,, 5, 7.
   ,, VII., Book II.
4. ,, XVII.–XVIII. in I. ,, 13, 16.
   Revise 4, 6 in Book II.

SECOND YEAR.

School Management.

1. Fitch, Lecture II. (First half.)
   Rules for Attendance Register.
   Feeling and its subdivisions.
2. Fitch, Lecture II. (Second half.)
   Same (A. R.).
   Organic Sensations—Smell—Taste
3. Fitch, Lecture II.
   Same (A. R.).
   Touch.
4. Fitch, Lecture II.
   Revise Admission Register Rules.
   Revise the Psychology.
   The Fallacy of Equivocation.

Composition.

As First Year.

Music.

1. The Divisions and their requirements.
2. Plans for sorting voices.
3. Hand signs and their use.
4. Musical terms.

English.

As First Year for Wordsworth and Grammar.
Also: Hamlet, Act I.
M.N.D., ,, Sc. I.

Geography.

As First Year.

History.

As First Year.
Also: Colonial Policy of Geo. III.
Rise of Newspapers and causes.
Treaties of Paris and Versailles.

Algebra.

As First Year.
Also 1. Geometric Progression.
2. Logs.
3. ,,
   Revise Arithmetic Progression.
4. Revise Logs and Arithmetic and Geometric Progressions.

Geometry.

As First Year.
Also 1. III. 14.
Definitions 1, 2 of Book V.
2. III. 15, 16.
Definitions 3, 4 of Book V.
3. III. 17, 18.
Definitions 5, 6, 7, 8.
4. III. 19, and Revise Definition 3.
Revise Definition 5.

Needlework.

First Year.
Practise all the stitches in chemise.
Revise diagrams.

Second Year.
Similarly for boy's shirt.
Revise diagrams.

First Year.
Par. 89–106.
Chapter on Care, etc., of Clothing.
Second Year.
As First Year.
Also Paris. 146–159.
} Nelson's 'Domestic Economy.'

or,

Geometry.

First Year.
Prop. III., IV., V., VI.
Revise Definitions.

Second Year.
As First Year.
Also Prop. 27, 28, 29, 30.

A Complete Set of

QUESTIONS SET AT A LONDON SCHOOL BOARD SCHOLARSHIP EXAMINATION

will appear next month.

QUERY COLUMN.

RULES.

1. Each correspondent is restricted to *one* question.
2. Each query must be accompanied by the *coupon* which appears on the back wrapper of the current number of the Journal.
3. CORRESPONDENTS MUST IN ALL CASES STATE THE SOURCE FROM WHICH THEIR QUERY HAS BEEN OBTAINED.

The Editor reserves to himself the right to decline to answer any question which is, in his judgment, unsuited to the Magazine.

Mignonette.—At what time between 9 and 10 o'clock will the hands of a clock be *opposite* each other?—(PRACTICAL TEACHER, September.)

We do not recommend you to *learn* some rule which will solve such problems, you should try to *think* clearly. There can be nothing with which you are more familiar than the fact that the minute-hand of a clock goes *twelve* times as fast as the hour-hand. Now just suppose that the hands indicate 9 o'clock exactly. If you were to hold the hour-hand fast you would clearly have to move the minute-hand 15 minutes before they were opposite to each other. But the hour-hand does not remain fast in a clock, it moves a little, and so the minute-hand will have to move this little bit beyond the 15 minutes before they are opposite each other. This little bit is *one*-twelfth of the motion of the minute-hand, hence the 15 minutes will be the remaining *eleven*-twelfths; that is, the minute-hand moves $\frac{11}{12}$ of 15, or $16\frac{4}{11}$ minutes. Or, if x = the required number of minutes past 9 o'clock, then the algebraic statement of the above reasoning is

$$x = 15 + \frac{x}{12}, \text{ or } \frac{11}{12}x = 15,$$

and $x = \frac{12}{11}$ of 15, or $16\frac{4}{11}$.

Tutor.—(*a*) If two cups, one a cylinder and the other a hemisphere, have the same diameter and volume, compare their heights.

(*b*) The volume of a cone is the same as that of a hemisphere on an equal base. Compare the height of the cone with the radius of the hemisphere.—('Scholarship' Mensuration.)

(*a*) If the radius (or height) of the hemisphere be r, its volume is $\frac{2}{3}\pi r^3$. If the radius of the cylinder is r, and its height h, its volume is $\pi r^2 . h$. If these volumes are equal we have $\frac{2}{3}\pi r^3 = \pi r^2 . h$; hence, cancelling πr^2, we have

$$\frac{r}{h} = \frac{2}{3}.$$

(*b*) If h' is the height of the cone, its volume is $\frac{1}{3}\pi r^2 h'$, and that of the hemisphere is $\frac{2}{3}\pi r^3$; hence, if these volumes are equal, h' is twice r.

'J. Dier.'—A person buys 6 p.c. bonds, the interest on which is paid yearly, and which are to be paid off at par 3 years after time of purchase; if money be worth 5 p.c., what price should be paid for the bonds?—('Pendlebury,' p. 255, No. 65.)

This is worked in PRACTICAL TEACHER, April 1897, p. 600.

'Caradog.'—

(1) Given A = 115°, B = 45°, C = 90°, find c.

(2) Given A = 90°, B = 120°, C = 135°, find sin $\frac{a}{2}$.

(Science and Art, 1888.)

(1) You will find in any text-book on spherical trigonometry that if C = 90°, cos c = cot A cot B, we have then cos c = cot 115°. cot 45° = — tan 25°.

Now the *minus* tells us that c is between 90° and 180°, so ignore the *minus* for the moment.

L cos c = L tan 25° = 9·6686725.

From your tables we have

L sin 27° 48′	= 9·6687461	9·6686725
L sin 27° 47′	= 9·6685064	9·6685064
	60″	2397	1661

Hence the angle whose L sin is 9·6686725 is 27° 47′ and $\frac{1661}{2397}$ of 60″ = 27° 47′ 41·6″. Therefore the angle whose L cos is 9·6686725 is 90° — 27° 47′ 41·6″, or 62° 12′ 18·4″. But now taking the *minus* into account, c = 180° — 62° 12′ 18·4″ = 107° 47′ 41·6″.

(2) $$\text{Sin } \frac{a}{2} = \sqrt{-\frac{\cos S . \cos (S - A)}{\sin B . \sin C}},$$

$S = \frac{1}{2}(A + B + C) = 172° 30'$

$$= \sqrt{-\frac{\cos 172° 30' . \cos 82° 30'}{\sin 120 . \sin 135}}$$

$$= \sqrt{-\frac{-\cos 7° 30' \sin 7° 30'}{\frac{\sqrt{3}}{2} . \frac{1}{\sqrt{2}}}}$$

$$= \sqrt{\frac{\sqrt{2}}{\sqrt{3}} . \sin 15°}$$

$$= \sqrt{\sqrt{\frac{2}{3}} . \frac{\sqrt{3}-1}{2\sqrt{2}}}$$

$$= \sqrt{\frac{\sqrt{3}-1}{2\sqrt{3}}} = \sqrt{\frac{1}{2} - \frac{\sqrt{3}}{6}}$$

$$= \sqrt{\cdot 288075} = \cdot 537.$$

W.S.—If BD, CE, be common tangents that intersect between the centres of two given circles, and AF one of the other common tangents, show that the portion of this third tangent intercepted between the first two tangents is equal to either BD or CE.—(Stage 2 Math., 1897.)

Please draw a figure to suit the question, B, C, A being on the same circle. Also let BD and CE meet at O; also let BD and CE meet AF in H and G respectively. There is formed a triangle HGO, and whichever circle we consider, it touches one side of this triangle not produced, and the two others produced.

Now CE = GE — GC = GF — GA (iii. 17)
= AH — AG (if AH = GF, yet to be proved)
= GH.

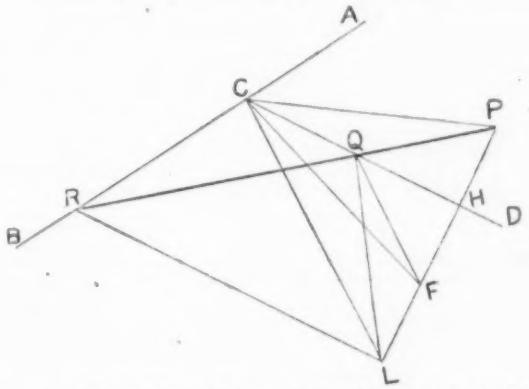
To prove AH = GF.

AH = $\frac{1}{2}$ (AH + HB) = $\frac{1}{2}$ ((AG + GH) + (BO + OH))
= $\frac{1}{2}$ (GC + GH + CO + OH) = $\frac{1}{2}$ perimeter of GOH.

GF = $\frac{1}{2}$ (GF + GE) = $\frac{1}{2}$ ((FH + HG) + (EO + OG))
= $\frac{1}{2}$ (HD + HG + DO + OG) = $\frac{1}{2}$ perimeter of GOH.

M. M. S.—Take C any point in a line AB and draw CD such that ACD is an acute angle; take P any point within the angle ACD. Show how to draw from P a line cutting CD in Q and CB in R, such that QR is twice PQ.—(Stage 1 Math., 1886.)

Draw a line PQR and *suppose* that it is the required line. Now a natural observation to make is that since QR = 2PQ, then the triangle CQR = 2CQP. We must then somehow try to arrange two such triangles. R and Q are of course unknown, and P must be a starting point. Now wherever Q is finally, PH is the altitude of CQP, so if we arrange that LH is 2PH, the triangle CQL will be double CQP, no matter



where Q is on CD. It is an easy step from L to R, for LR must be parallel to CD if we wish CQR to = CLQ = 2CQP. The foregoing is only in the way of a suggestion.

An actual solution is:—Draw PHL perpendicular to CD, making HL = 2PH; draw LR parallel to CD and join RP, then QR = 2PQ. For, join LC, LQ, also bisect LH at F and join FQ, FC,

Then CRQ = CQL (I. 37) = CLH — LQH
= 2CHP — 2QHP = 2(CHP — QHP)
= 2CQP.

But if RQ were bisected at O, COQ would equal CQP, and hence OQ = QP, therefore RQ = 2QP.

For want of space several replies are crowded out. If 'E. J. Jones,' 'Taiwo,' and 'C. H. F.' will kindly send names and addresses to the Editor, replies will follow by the return post.

OUR SCIENCE SECTION

NOTES ON PHYSIOLOGY:

EMBRACING THE SUBJECTS OF THE ADVANCED AND HONOURS STAGES, SCIENCE AND ART DEPARTMENT.

BY WALKER OVEREND, M.A., M.D. (OXON), B.SC. (LONDON),

Physician to the Tottenham Hospital;
Late Radcliffe Fellow, Scholar of Balliol College, and Exhibitioner in Comparative Anatomy of the London University.

ANSWERS TO QUESTIONS, MAY 1897.

21. Describe carefully the minute structure of a medium-sized artery. In what respects is the structure of a large and of a very small artery different from that of a medium-sized artery? What is the exact importance of these differences in connection with the circulation of the blood, and how are they brought into play? (52.)

This question has been asked, under different forms, repeatedly, and it is intended to give the student an opportunity of demonstrating to the examiner that he understands the important subjects of elasticity and contractility, and the part they play in the mechanism of the circulation.

A medium-sized artery consists of three coats, (1) the innermost coat, or *tunica intima*, which consists of a fine layer of fibrous tissue containing elastic fibres, which are arranged in the form of a membrane. This is lined internally by a layer of irregular, flat, nucleated cells, called the endothelium. This endothelium lies therefore in contact with the blood. (2) The middle coat consists almost *entirely* of a ring of non-striped muscular tissue. Very little connective tissue is found in this coat. (3) The outer coat, or *tunica adventitia*, consists of fine fibrous and elastic tissue.

In a large artery the same number of coats are distinguishable under the higher powers of the microscope; but the middle coat consists almost entirely of connective tissue containing elastic fibres arranged circularly, and the outer coat is much stronger and tougher than in a medium-sized artery. In the smallest arteries the middle coat consists of transversely-arranged muscular fibres only, and no elastic tissue; and the outer coat is a thin, structureless membrane.

The property of elasticity is conferred upon the arteries by virtue of the existence of elastic fibres, and is therefore purely of a physical nature, and most marked in the largest arteries. It is of the greatest importance in converting the spasmodic and interrupted flow of blood issuing from the heart into a uniform flow in the capillaries. (See former notes.) The power of contractility, on the other hand, is a vital property depending upon the unstriped muscular fibres, and the vasomotor nerves which enter them, and these again are regulated by the vasomotor centre in the medulla oblongata. By its means the calibre, or lumen, of the artery is altered, and as a result the amount of blood entering the part is increased or diminished.

22. Give an account of the Vagus or pneumogastric nerve, so as to explain (1) its origin from the brain; (2) the outlying parts of the body to which it is distributed; (3) its chief functions in the order of their relative importance (52.)

The glossopharyngeal, vagus, and spinal accessory nerves arise from a large collection of nerve-cells in the lateral part of the medulla oblongata, and the vagus leaves the medulla by means of ten or more fine roots, which unite to form the nerve; and as the vagus leaves the skull there is a swelling or ganglion upon it corresponding to the ganglion on the posterior root of a spinal nerve.

The Vagus has a wide distribution. It sends an

(*a*) *auricular* branch to the ear;
(*b*) *laryngeal* branches (superior and inferior) to the larynx;
(*c*) *cardiac* branches to the heart;
(*d*) *pulmonary* branches to the lungs;
(*e*) *œsophageal* to the œsophagus;
(*f*) *gastric* branches to the stomach, which also pass to the small intestine.

Of these the cardiac branches take the most important place. Some carry impressions to the heart, which slow and finally stop the heart in diastole (see former notes); others (depressor) carry up impulses from the heart to the vasomotor centre, and these impulses are followed by dilatation of the blood vessels in the abdomen and a great fall in blood pressure.

The pulmonary branches are also of vital importance. They carry up impulses to the respiratory centre from the air-cells which accelerate inspiration. The branches in the superior laryngeal are also afferent, and carry up impulses which produce a contrary result.

The branches to the œsophagus, stomach, and small intestines carry impulses which induce muscular activity, and in the small intestine excite peristalsis. The fibres in the recurrent or inferior laryngeal supply the muscles of the larynx except one, the circo-thyroid.

The student of advanced physiology is advised to devote a considerable time to practical work, inasmuch as his endeavour, in the first instance, should be to acquire an intimate and personal acquaintance with the details. With regard to Histology, it is of the greatest importance to study the elementary tissues in the fresh state—connective tissue, elastic tissue, connective tissue corpuscles, fat-cells, muscle striped and unstriped, nerve-fibres and nerve-cells, marrow-cells, blood corpuscles. They should be stained by appropriate methods. Logwood is the best stain for general use, and can be obtained from any of the dealers—as Beck, of High Holborn, London. A microscopic case (students') can be obtained from Arnold & Sons, Smithfield, London, containing razor, embedding-box, scalpel, needles, lifter, slides, watch-glasses, &c., for 17s. 6d. A special lamp for illuminating purposes and for use with the microscope in winter is necessary. Beck's histological microscope will be found suitable; but whatever form is selected, care should be taken that it has two powers—one an inch, and the second, a higher, about ¼ in., and there should be a double-nose piece, also a rough and a fine adjustment. Such a microscope may be bought for from four to five guineas. As regards books, Kirke's 'Physiology,' edited and rewritten by Halliburton, can be recommended with confidence for the advanced stage. For the elementary stage, several text-books are available, viz., Foster & Shore's 'Elementary Physiology,' published by Macmillan; Huxley's 'Physiology,' also by the same publishers; and for the practical work, Pilley's 'Practical Physiology,' published by George Bell & Sons. For the Honours Stage, Kirke's 'Physiology' should be thoroughly mastered. Starling's 'Elements of Physiology' will be found useful. For reference, Landor's text-book of 'Human Physiology,' published by Griffin, with Stirling's works, one on Histology, and the second on Practical Physiology. For the Honours Stage special work in a physiological laboratory must be done, particularly on muscle and nerve, the galvanometer, the properties of curarised muscle, &c., and advanced work in staining with silver nitrate, chloride of gold, &c.

CHEMISTRY NOTES.

BY THOMAS CARTWRIGHT, B.A., B.SC. (LOND.),
First Class Honoursman in Chemistry (Science and Art Department), Head Master, Finchley Organised Science School, and Lecturer therein on Chemistry.

Annual Review of Pure Chemistry.—The *Chemical News* gives a review of the year's chemistry as described by M. Étard in 'La Revue des Sciences Pures et Appliqués,' which cannot fail to interest our readers; we, therefore, reprint the note with acknowledgments to our contemporary.

'One of the most important events of the year in pure chemistry is the liquefaction of fluorine by Messrs. Moissan and Dewar. Of the other less important work, the author sees nothing but a little more confusion, owing to the monotonous continuity of scientific productions of unequal value. The science of chemistry is extending every year in new directions. It is being enriched principally by the determination of volumes, by the measurement of constants, and in more minute work striving to show if what we have so long admitted is really true. After a long period, during which it has seemed that science was getting so pure as to be useless, savants

are coming back to the traditions of Gay, Lussac, and Berthollet, and are endeavouring to adapt the modern lofty ideas to the wants of mankind. Thus Lord Rayleigh proposes to make the oxidation of the nitrogen of the air commercially practicable by means of the electric currents which are now at the disposal of chemists. He found that with an electromotive force of 6,000 volts, the absorption of air in a 7-litre flask in which played a spray of potash reached 0.880 cc. per hour. Mr. Liversedge has tested various deposits of maritime origin for gold, and has found that the Starsfurt salts contain ·13 gms. per ton. But it is not only gold that is so widely disseminated, but, as Mr. Hartley has shown, also the so-called rare earths and metals. In 92 different iron ores he found always either silver, rubidium, copper, gallium, indium, or thallium. Mr. Shenstone has found that the halogens Cl, Br, and I combine with mercury when in a state of perfect dryness, but ozone will not do so except in the presence of aqueous vapour. Mr. Chattaway has studied the composition of iodide of nitrogen, and comes to the conclusion that NH_3I_2 is the most probable formula, certainly the *rapport* N : I_2 has been established.'

Qualitative Separation of Fe. Al, Cr, Mn, Zn, Ni, and Co.—By Alexander Ramsay Cushman, from the *Chemical News*.

'Add ammonium chloride, ammonia to alkaline reaction, and then ammonium sulphide in slight excess. Warm and filter. Wash the precipitate, and remove from the filter while still moist. Warm with moderately dilute HCl in a porcelain dish. Complete solution of the precipitate shows **absence of Ni and Co**. If a black residue remains, one or both are present, in which case add aqua regia, and warm gently until dissolved. Expel excess of acid and free Cl by evaporation, and then make the solution strongly alkaline with ammonia, after previously adding ammonium chloride in case the amount of HCl used upon the sulphides was small. Add bromine water in excess, and allow to stand a few minutes. Filter the wash. The table shows the course of the analysis after this point is reached.

Precipitate 1.—Fe_2O_3, $MnO_2.H_2O$, $Al_2(OH)_6$, $Cr_2(OH)_6$. Remove from the filter, and add KOH in excess, then Br water and filter.

Filtrate 1.—$ZnCl_2.2NH_4Cl$, $NiCl_2.NH_4Cl$, $[Cl.Co(NH_3)_5]Cl_2$. Add KOH in large excess, allow to stand a few minutes, and filter.

Residue 2.—Fe_2O_3, $MnO_2.H_2O$. Divide in two parts.

Part 1.—Dissolve in HCl, add a few drops NH_4CNS. Blood-red colour shows $Fe_2(CNS)_6$, and proves Fe.

Part 2.—Fuse with $Na_2CO_3 + NaNO_3$ in O. F. of blow-pipe. Bluish green mass proves Mn.

Filtrate 2.—$K_2Al_2O_4$, K_2CrO_4. Divide in two parts.

Part 1.—Acidify with HCl, add excess of $(NH_4)_2CO_3$, and boil. A white flocculent precipitate shows $Al_2(OH)_6$, and proves Al.

Part 2.—Acidify with $HC_2H_3O_2$, and add $Pb(C_2H_3O_2)_2$. A yellow precipitate shows $PbCrO_4$, and proves Cr.

Precipitate 3.—$Ni(OH)_2$. Greenish white. Confirm in salts of phosphorus bead in the R. F. of the blow-pipe. Yellow bead cold proves Ni.

Precipitate 4.—$Co(OH)_3$. Confirm in borax bead in the O. F. of the blow-pipe. Blue bead proves Co.

Filtrate 3.—$[Cl.Co(NH_3)_5]Cl_2$, K_2O, ZnO. Heat to boiling, and filter.

Filtrate 4.—Acidify with $HC_2H_3O_2$, and saturate with H_2S. A white flocculent precipitate shows ZnS. Confirm by ignition with $Co(NO_3)_2$ on charcoal. Yellow green mass proves Zn.

Precipitation of Cu by Mg.—This contribution of Mr. E. E. Bryant cannot fail to interest both teachers and students, since it deals with the great source of complaint as to the examination in Elementary Practical Chemistry of May last, the chief item in which was the exercise discussed in this paper; indeed, the bitter cry of the examinee undoubtedly set Mr. Bryant to work to see if the cry were justifiable or no. And in the main he has to confess that it was.

Taking commercial Mg ribbon, $CuSO_4$ and $CuCl_2$, he thoroughly cleaned the ribbon, and recrystallised the sulphate. After precipitation the copper obtained was washed by decantation, dried and weighed as copper or as copper oxide. (It will be remembered that the candidates were to weigh as oxide).

'*My experience*,' says the writer, '*seems to show that it is easier, unless a furnace or foot blow-pipe be at hand, to get good results with metallic copper than with the oxide, as an ordinary Bunsen takes a considerable time to oxidise even a hundred or so mgms. of the metal.*'

(This is the pith and marrow of the complaint. The exercise was an impossible one in the time given.) 101·7 mgms of Cu were obtained by placing 105·2 mgms. of Zn in a warm solution of copper sulphate, which gives an equivalent of 62·8 for the Cu.

'I have made a large number of experiments with magnesium and copper sulphate and chloride, using both dilute and concentrated solutions at about 18°, 50° and 92° C., also solutions made alkaline with ammonia and sodium hydrate, but **invariably with unsatisfactory results.** The copper or copper oxide obtained varies greatly in amount, but is never much above 70 per cent. of the theoretical quantity. The highest results were given by hot concentrated solutions; **in dilute or cold solution the process required hours to complete, and the results were under 50 per cent.** In every case a considerable amount of hydrogen was generated, and more or less of the Mg became oxidised. The magnesium oxide in turn displaced copper hydrate, so that a greenish sediment was always found accompanying the precipitated copper. Very dilute HCl was used to dissolve this greenish substance, and a small quantity of the copper was removed at the same time.

'The results obtained from perfectly pure Mg might be very different from the above.'

Mr. Bryant gives three of his results:—

Mg.	Cu.	Cu (theoretical).	
·055 gms.	·079	·144	Strong solution at about 50° C. 1 hr.
·055 ,,	·064	·144	Strong solution at 18° C. Several hrs.
·065 ,,	·137	·171	Concentrated solution at 80° C. A few minutes only.

It is pretty clear that someone must have blundered at South Kensington in respect to this test.

Chemistry at the British Association.—The annual address of the President of the Chemical Section of the British Association is always worthy of the best attention of all degrees of chemists, and the address of Prof. Wm. Ramsay at Toronto was of supreme interest, the subject thereof being **An Undiscovered Gas.** The address is much too long for insertion; indeed, all we can do is to give the briefest outline of it, and refer our readers to *Nature* and the *Chemical News* and such like journals, wherein the address is to be found *in extenso*.

In the opening remarks was given the history of the Periodic Law, the arrangement of elements in *groups of three* by **Döbereiner** in 1817 being the starting point. Ba, Sr, Ca were thus easily recognised as a triad group whose properties had the same sequence as their atomic weights. **Pettenkofer** comes next, followed by **Dumas**, but it was **John Newlands**, in 1864, who, having arranged the elements in groups of eight, found that when placed in the order of their atomic weights '*the eighth element, starting from a given one, is a kind of repetition of the first, like the eighth note of an octave in music.*' *This was the Law of Octaves.* But the credit of developing the idea belongs to Lothar Meyer of Tübingen, and Mendeleeff of St. Petersburg. We need not state the Periodic Law: it is to be found now in all text-books.

The discovery of argon led to the question as to its position in the list of elements arranged in accordance with this law; and when helium of like nature in respect to inertness came to light, then it was asked whether we had not happed, not upon two new elements, but upon a group of elements whose inactivity had hitherto shielded them from the inquiring eye of the experimenter. This is further borne out by the peculiar density of argon, which is undoubtedly a monatomic element whose atomic weight is 40, the atomic weight of helium being 4. 'There should therefore be an element between argon and helium, reasoning from the analogy of the various groups

whose existence is beyond cavil.' Prof. Ramsay details his journeyings and his labours in quest of this new element which is still to seek.

1. Minerals were heated *in vacuo*, but although all gave out various gases, amongst them helium and argon, no new one was found.

2. Water was tried from the boiling springs of Iceland, from the mineral springs of Canteret; but no new gas was found in company with helium and argon.

3. Spectroscopy was called into requisition, and as a result came the declaration that helium, judging from its spectrum, was a mixture of two gases.

4. Then came attempts to separate the two by diffusion, from which it was learnt (*a*) that there were two portions, one with a density of 2 and another with a density equal to 2·4; (*b*) that helium has a rate of diffusion too rapid for its density, for the density of the lighter portion worked out as 1·874, calculating from its rate of diffusion its actual density being 2, as aforesaid. (*c*) Although the two portions differed in the rate at which they allow light to pass through them, they gave exact spectra, hence it is believed that by diffusion the gas is simply separated into its lighter and heavier molecules, the atomic weight of an element, as shown by Schützenheyer and Crookes, being the mean of the different densities of the various molecules. 'When we say that the atomic weight of oxygen is 16, we merely state that the average atomic weight is 16; and it is not inconceivable that a certain number of molecules have a weight somewhat higher than 32, while a certain number have a lower weight.'

To test this, nitrogen was experimented upon, with the result that there was no difference whatever between the first and the last portions of the diffusion with respect to density, hence the abandonment of the theory and the belief that the difference in the density of the two fractions of helium was due to the separation of light molecules of helium from heavy molecules. To be brief, Prof. Ramsay acknowledges that the heavier portion, which by subsequent re-diffusion gave a density as high as 2·275, was argon, and helium must be considered elemental, and so the quest up to now has failed. The address concluded with a reference to, and a consideration of, the atomic weight of argon, the gist of which will be gathered from the following quotation:—'The atomic weight of argon is 40; it has no power to form compounds, and thus possesses no valency; it must follow Cl in the periodic table, and precede potassium; but its atomic weight is greater than that of K, whereas it is generally contended that the elements should follow each other in the order of their atomic weights. If this contention is correct, argon should have an atomic weight smaller than 40.'

In what follows Prof. Ramsay shows a similar discrepancy in the case of iodine and tellurium, from which and other considerations he leans towards argon and against the periodic table. But as the earnest student will read the address for himself, we must desist.

Text Books.—(*a*) **Elementary.**—Messrs. Macmillan have forwarded us a parcel of their works on Elementary Chemistry, all of which are excellent in their several ways. (1) **Turpin's 'Practical Inorganic Chemistry'** can be recommended as thoroughly reliable as a guide to the Xp Elementary Examination of the Science and Art Department. It is in strict accordance with the latest requirements and suggestions. (2) **Jones' 'Junior Course of Practical Chemistry'** is a new edition of a well-known work. It more than covers the course, and contains much useful information in just the right form. (3) **'Introduction to the Study of Chemistry,'** by Parkin and Lean, is a book written on new lines. It is strong in the historical and is wisely inductive in character, nothing being assumed until proved. Besides the Chemistry necessary to the passing of Xp Elementary, all the physics requisite to make this chemistry clear is given in experimental form. As a *vade-mecum* to a knowledge of chemistry by way of experiment the book is unsurpassed. (4) **'Inorganic Chemistry for Beginners,'** by Roscoe and Lunt. This book covers X Elementary, and is written with all the clearness and accuracy for which Sir Henry Roscoe is so justly esteemed. No better elementary book can be desired. (5) **Remsen's 'Elements of Chemistry.'** This would be a useful book for the Alternative Chemistry Course, as it contains simple chapters on the more common of the non-metals, metals, and organic compounds. Both in America and in this country the manuals of Remsen are valued for their excellence, which is conspicuous on every page of the 'Elements.' (6) **'Questions on Chemistry,'** by Francis Jones. The questions cover both Inorganic and Organic Chemistry, and can be recommended as typical and searching. (6) **Turpin's 'Elementary Organic Chemistry'** can be used as a good and easy guide to a difficult subject. The works of Reynolds, Newth, Jago, Clowes, and Seaton are also of great value.

(*b*) **Advanced.**—Professor Tilden has just written a practically new work based on Fowne's 'Manual.' Every advanced student should read up from this book, which contains all the latest discoveries of importance to the student. The price of the book is 10s., and it is published by Messrs. J. and A. Churchill.

(*c*) **Honours.**—Tilden's 'Manual' is the best book here, but it must be followed up by more special books, such as in 'History,' 'The Alembic Club Reprints,' Wurtz's 'Atomic Theory,' Muir's 'Principles,' and by reading the *Chemical News*, the *Journal of the Chemical Society*, and other up-to-date literature.

PHYSIOGRAPHY NOTES.

The Age of the Earth.—Lord Kelvin, in a recent address, touched upon the old but interesting question of the age of the earth, and especially as to the period when our planet became habitable. In his opinion the earth solidified from twenty to thirty millions of years ago, consequently it could not have been habitable for a period longer than thirty millions of years.

The Height of Clouds.—A method of determining the height of clouds, and especially of the ill-defined stratus cloud, by means of the search light, was suggested by Professor Cleveland Abbe many years ago. It was proposed to establish a search light, the beams of which should be vertical; the apparent altitude of the centre of the luminous spot of the cloud was to be observed from a station not far away, and the height was a matter of easy calculation. Professor Abbe returns to the subject in the monthly Weather Review, and points out that with the great increase in power of the modern search light, further applications have become practicable; thus, in harbours on the sea coast, where one wishes to ascertain the presence and development of low-lying fogs, the search light which renders them visible is an admirable assistant. A year ago some accounts were published relative to the cloud effects upon Mount Low and Passadena. According to these accounts, Mount Low is about fifteen miles N.N.E. from Los Angeles, and about six miles in a straight line from Passadena. 'When the beam of light fell upon the bodies of clouds, they at once became luminous, so that all the detail of motion was visible; when the beam fell upon the falling rain, the great cone of light glowed like molten metal. It seems, concludes Professor Abbe, that the formation and motion of fog and rain at night-time could be advantageously studied by means of the search light. The height at which fog first forms, and its gradual extension upwards and downwards during the night, would be a very interesting and profitable investigation.

The Leonids.—In the *Observatory* Mr. Denny is devoting considerable attention to these meteorities, the epochal display of which should occur in 1899. 'A meteoric system stretches over such an extensive space, that its various sections are liable to be perturbed in very different degree by the planets passing near, so that it is often encountering vicissitudes of sufficient weight to change its distribution and form of orbit. Thus the Leonid shower of 1899 and bordering years may not furnish a counterpart to those which marked the epochs about 1833 and 1866, as considerable changes may have operated since then to alter the visible aspect of the display. That such changes do occur is certain, but it is probable that they are rarely of sufficient magnitude to bring about the violent derangement of a system between successive returns. The changes have probably a more gradual influence in increasing the duration of the shower at each of its annual returns, and one result, chiefly of its physical construction, must be to lengthen out the group about the orbit, so that at a distant period in the future the Leonids will be resolved into a similar shower to the Perseids in August, and exhibit no very brilliant maxima, but a regular annual shower of moderate intensity. In every November until 1904 there will be prominent showers.

The 1897 Display.—'In 1864 (two years before the maximum of 1866) a grand display of meteors was witnessed from the deck of a ship off Malta on the morning of November 13, and meteors were conspicuously numerous on the same morning in America. We are, therefore, entitled to expect a pretty abundant display in 1897, and should it prove a return of the same group which supplied the meteors of 1864, it should return on the morning of November 14. But the earth will intersect a point of the meteoric orbit rather further in advance of the comet than it did in 1864, and so the exhibition of 1897 is not likely to equal the former, unless, indeed, the richer part of the stream has lengthened out in the interval of thirty-three years, which is quite possible. The really dense part of the system which furnished the brilliant European display of 1866, and the equally imposing American shower of 1867, is not likely to be visible in England, as the earth will be centrally involved with it on the 14th at midday. In America something of it may possibly be seen just before sunrise on the 14th.'

Rainfall in Western Europe.—M. Angot, in the Annales of the Central Meteorological Office of France, has published some interesting recent facts in connection with the above. He has discussed the monthly and seasonal values of 275 stations for the years 1861–90. The values are given both in tabular form and upon charts, and a short discussion for each month explains the features of the rainfall. The yearly chart shows that the driest regions where the rainfall is less than 20 inches are few in number, and small in extent. Outside the Iberian Peninsula there are only five such regions—the south-east coast of Sweden, two in Bohemia, and two in France. In Spain there are several large areas where the fall does not reach that amount, the minimum value being 11·3 inches at Salamanca. Smaller values are recorded in Russia. The greatest amounts are found in Scotland, Cumberland, the southern slopes of the Alps, and the mountainous regions of Upper Austria, where the fall exceeds 26 inches.

Cold Weather in Australia.—There have been three falls of snow in the Victorian Alps within the three months, January to March 1897, and Mounts Bogong and Feathertop were covered with snow in the latter month. Mr. Baracchi says that the cause is 'the backing of the Antarctic depression, which has been arrested in its eastern course by suction at the equator.' Mr. Russell, of New South Wales, attributes the cold weather to an extensive high pressure of great energy, which has come almost in a direct line from West Australia. It is also suggested that the cause of the cold weather was the unwonted number of icebergs and icefields in the southern ocean, for almost every ship that hailed from the Cape passed through hundreds of miles of ice.

Icebergs from Victoria Land.—In some years the pack-ice and icebergs from Victoria Land drift in vast quantities further north than in others, and the cause of their abundance this year is, according to the U. S. Hydrographic Department, the great volcanic disturbances which have broken up the polar sea, and set it adrift. Mr. Russell's explanation is that we owe their presence to the long continuance of southerly and south-westerly winds. It is, however, only reasonable to conclude that there is an intimate association between the cold weather and the icebergs. Usually the air blows over a large expanse of open ocean, which warms it before it reaches the coast of Australia; but in the present year it was chilled by blowing over vast fields of ice and icebergs.

Earthquake at Hereford.—A slight earthquake shock was felt at Hereford on Monday morning, July 19th, between half past three and four. Mr. E. Armitage, writing from Dudnor, Ross, Hereford, to *Nature*, says that the disturbance was felt at 3.50 a.m. He adds, 'The rumbling sound was accompanied by a distinct shock of momentary duration sufficiently strong to awaken sleepers.' The direction of the seismic wave was from east to west.

New Asteroids.—Two new planets have just been discovered between Mars and Jupiter by M. Charlois, an astronomer of Nice. M. Charlois probably holds the record for the number of planets he has discovered in his lifetime. His nearest rival is the Austrian astronomer Herr Palisa, who has discovered eighty-three, but he falls short of M. Charlois's record by three.

Text Books.—(*a*) *Section I.*, Cartwright's 'Physiography.' (*b*) *Elementary*, Gregory's 'Elementary Physiography.' (*c*) *Advanced*, Gregory's 'Advanced Physiography.' (*d*) *Honours*, Gregory's 'Honours Physiography,' Judd's 'Volcanoes,' Lockyer's 'Eclipses, Past and Present' (new work about to be issued).

For new work the various publications of the Meteorological, Geological, and Astronomical Societies should be read, according to which of these three divisions the student aims at specialising in.

ELECTRICITY AND MAGNETISM.

BY EDWIN EDSER, A.R.C.S., F.PH.S.,

MANY students will now be commencing to prepare themselves for the advanced examination in electricity and magnetism to be held next May by the Science and Art Department. A few words of advice to these may prove of service.

As every student knows who has followed the questions set, the advanced examination in electricity and magnetism is, at present, one of considerable difficulty. A general knowledge such as would a few years ago have proved amply sufficient for the acquisition of a 'pass' or a 'first class,' would now scarcely prevent the student from incurring a fine to the class he attends. What is required more than anything else is *precision*; and that involves familiarity with the elementary mathematical treatment of the subject. The mathematics is not of a high order of difficulty; some simple algebraical transformations, the Binomial theorem, and the properties of the trigonometrical ratios comprise almost all that is required. But the student must be ready to apply these at a moment's notice to problems which, though similar, are by no means identical with those to be met with in text-books. This readiness can only be obtained by constant practice; the answers to questions set during the last three years, which have appeared in these pages, should, however, give the student an opportunity of making himself familiar with the necessary methods of procedure.

Unfortunately there is no text-book at present on the market which is precisely what the student requires. Unquestionably the best work is Prof. J. J. Thomson's 'Elementary Theory of Electricity and Magnetism.' But the occasional use of the Integral Calculus may scare the elementary student, whilst there is much that is beyond what he is required to know; for instance, the chapter on Electrical Images and Inversion may be omitted. Another good book, though it is little more than a *résumé* of the most important points in our knowledge of electricity, is Prof. Silvanus Thompson's 'Electricity and Magnetism.' Outside of these, Stewart's book in the 'University Tutorial Correspondence Series' is useful in many ways, though far too little stress is laid on the treatment of problems by means of lines of force. Beside these books I know of scarcely any that would be useful except for casual consultation.

To show the importance of the treatment of problems in statical electricity by means of lines of force, the student might be reminded that before the last Science and Art examination the subject was carefully treated from that standpoint in these pages, with the result that one question was definitely anticipated, whilst another was only a simple modification of a problem solved. The student must endeavour to see, as Faraday saw, charged bodies surrounded by lines of force, which produce the mechanical actions which we ascribe to statical electricity. When this has been accomplished a great step will have been made.

The following are some of the most important points in statical electricity that the student should attend to:—

1. Electric charge concentrated at a point. Definition of *unit quantity of electricity*.

2. Definition of Potential and Difference of Potential. Note that—

Potential Difference (P.D.) between two points = force × unit quantity of electricity × distance between points.

∴ Electric Force = P.D. ÷ distance between the points, *i.e.*, the force at any point is the Potential Difference per unit distance, or the rate of increase of Potential per unit distance.

3. Charge, Potential, and capacity of a sphere. Field due to a charged sphere. Potential of any point in the neighbourhood of a sphere.

4. Charge, Potential, and capacity of two hollow concentric spherical conductors.

5. Potential of a sphere brought into the neighbourhood of a charged body. Charge on sphere when it is earthed.

This last problem introduces a most important fact to our notice, viz., that a sphere may be charged with electricity, and yet if it be placed in a suitable electric field, none of the electricity will leave it when it is connected with earth.

The student will find it a good exercise to account for this last fact without using mathematics, by the method of lines of force.

Capacity.—It will be remembered that the definition of capacity is 'the quantity of electricity necessary to raise the potential of a condenser by one unit of potential.' Consider a condenser formed of two parallel plates, the area of each being great in comparison with the distance between them. If σ represents the surface density of electricity on either plate (*i.e.* the quantity of electricity per unit area of plate), then $4\pi\sigma$ lines of force will leave each sq. cm. of the plate normally; and since, in air, the force that would be exerted on a + unit of electricity at any place is denoted by the number of lines of force per sq. cm., the force at any point between the plates will be $4\pi\sigma$. Consequently the work done in bringing a + unit of electricity from one plate to the other = $4\pi\sigma \times d$, where d = distance between the plates.

If now the plates are brought nearer to each other, σ remaining constant, the potential of the condenser will decrease. To maintain the potential constant, the number of lines of force per sq. cm. must increase as the distance of the plates diminishes; that is σd = constant. Therefore, to maintain the potential constant whilst the distance between the plates is decreased, the charge of the condenser must be increased.

Mechanical Force between two Infinite Plates, oppositely charged with Electricity.—It has just been shown that the electric force or potential difference per unit distance, between two infinite plates, oppositely charged with surface density = σ, is equal to $4\pi\sigma$. This is the force that would be exerted on a + unit of electricity if placed between the plates.

The student must carefully distinguish between this electric force and the mechanical force attracting one plate to the other. In the first case a + unit of electricity is introduced into a field, which was before $= 4\pi\sigma$, and the force therefore is equal to $4\pi\sigma$. If we take an element of either plate, say of unit area, the electricity on it will be equal to σ. We cannot, however, find the force acting on this σ units by multiplying σ by $4\pi\sigma$, because now the field would not be equal to $4\pi\sigma$ if the σ units on the unit element of area were removed.

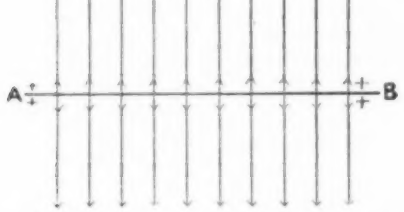


FIG. 1.—Lines of force due to part of infinite plane, charged positively.

Let AB, fig. 1, represent part of an infinite plane, charged with σ units of + electricity per unit area. Then, owing to the lateral repulsion exerted by one line of force on another extending in the same direction, these lines of force which leave the surface AB normally will continue as parallel straight lines. Also, as many lines of force will leave one side as the other, and since, as has been shown in a previous article, 4π lines of force leave every unit of electricity, $4\pi\sigma$ lines of force will leave each unit area. Of these, half will go upwards, whilst the other half will proceed in the opposite direction.

Consequently the number of lines of force per sq. cm. anywhere near the plane AB will be $2\pi\sigma$.

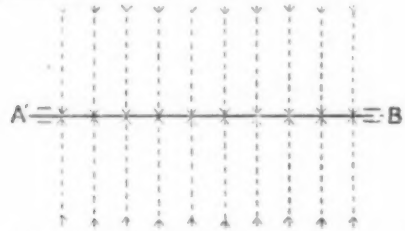


FIG. 2.—Lines of force due to part of infinite plane, charged negatively.

If the plate had been charged negatively instead of positively, $2\pi\sigma$ lines of force would enter unit area on either side (fig. 2).

Now let A'B' be placed at a distance d from AB; the disposition of lines of force will be that shown in Fig. 3. It will be seen that

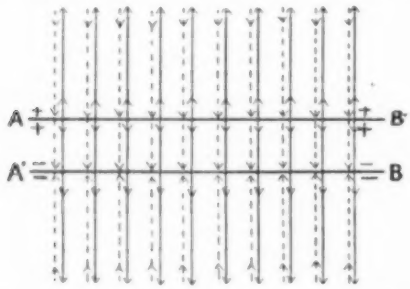


FIG. 3.—Superposition of Figs. 1 and 2. Lines of force due to charged plane condenser.

in the space outside the two plates, for every line of force running in one direction from one of the plates, there will be another line of force running in the opposite direction, due to the other plate.

In the space between the plates, however, the lines of force run in the same direction; therefore the total number of lines of force per sq. cm. in the space between the plates = number of lines due to AB + number of lines due to A'B' $= 2\pi\sigma + 2\pi\sigma = 4\pi\sigma$, the result formerly obtained.

To find the mechanical force on the plate A'B', attracting it toward AB, take unit area on A'B'; this will be charged with σ units of electricity, and consequently when placed in the field $2\pi\sigma$ due to AB, will be acted on by a force $= 2\pi\sigma \times \sigma = 2\pi\sigma^2$ dynes.

This can be put in another form, when the potential of the condenser is given. For if V = difference of potential of the two plates

$$4\pi\sigma \times d = V;$$

$$\therefore \sigma = \frac{V}{4\pi d}$$

Consequently the force per unit area on each plate

$$= 2\pi\sigma^2 = 2\pi \times \frac{V^2}{(4\pi d)^2} = \frac{V^2}{8\pi d^2} \quad (1)$$

If the area of one of the plates = S, the total force acting on that plate will be $2\pi\sigma^2 \times S$,

$$\text{or } \frac{SV^2}{8\pi d^2} \quad (2)$$

(To be continued.)

MATHEMATICS.

STAGES 2 AND 3, SCIENCE AND ART DEPARTMENT.

BY G. A. BAXANDALL,

Assistant, Mathematical Division, Royal College of Science, London.

At the request of many readers who have expressed their intention to follow the notes which will be given each month, we shall mention the text books to which reference will be constantly made.

STAGE 2.

Algebra.—Hamblin Smith's 'Elementary Algebra,' published by Rivington's, *or* Hall and Knight's 'Elementary Algebra,' published by Macmillan. To a student who does not possess either of these we should recommend the latter.

Trigonometry.—Loney's 'Plane Trigonometry,' Cambridge Univ. Press; Lock's 'Elementary Trigonometry,' Macmillan's; *or* Hamblin Smith's 'Trigonometry.' To students who do not possess any of these, we should recommend the first.

Euclid.—Hall and Stevens, Macmillan's; Todhunter's, *or* Nixon's 'Euclid Revised,' Clarendon Press.

STAGE 3.

Algebra.—Hall and Knight's 'Higher Algebra,' *or* Todhunter and Loney's 'Algebra,' *or* Todhunter's 'Algebra,' all published by Macmillan. To students who possess none of these we should recommend the first.

Plane Trigonometry.—Loney's or Todhunter's 'Plane Trigonometry.'

Euclid.—Nixon's 'Euclid Revised,' Clarendon Press.

Advice to Students who are entering upon the work for Stage 2.—Do not be too ready to think that you know your Elementary Algebra thoroughly. Any success which may attend your work in the more advanced stages will depend, in great measure, on the readiness with which you can *resolve expressions into factors*, or *simplify expressions*. You may not realise this now, but you will surely do so at a later period. Turn back, then, to the chapters which deal with these sections, and let it be your duty to work one or two examples from these each day during the next month or so. This must not on any account be shirked; we shall expect it from each reader who follows these notes. It will also be a capital exercise to work out many problems which lead to simple equations.

Trigonometry.—It is perhaps usual to commence the study of Trigonometry with the consideration of the various ways of measuring angles; we shall, however, postpone this for a short time. You may, instead, turn to the chapter on Trigonometrical Ratios of an angle in your text-book, and learn the definitions of the six trigonometrical ratios, the sine, cosine, tangent, cosecant, secant, and cotangent of an angle. When you have done this, you may with advantage consider the following problem:—

1. You are seated at your desk, on which is a blank sheet of paper, and on which you draw any acute angle. You wish your friend, who is in the next room, to also draw an angle of the same magnitude; what information might you give him which would enable him to do this? Probably you would give him the number of degrees in the angle; we wish, however, this method to be not allowable.

Other examples.

2. In a triangle ABC, right-angled at C, AC = 3, BC = 4. Write down the values of the six trigonometrical ratios for the angles CAB, CBA. Do the same for the cases in which AC = 1, BC = 2; AB = 2, AC = 1; AC = BC; AB = 2BC. If you find that you do not know the definitions of the six ratios thoroughly, make more exercises for yourself. We are assuming here that you know how to apply Prop. 47, Book I., to find the third side a right-angled triangle when you have given the other two sides; this you will find at the beginning of your text-book.

Observe that if you have given the value of any one of the six ratios for one of the acute angles of a right-angled triangle, you can find the six ratios for the other angle.

You may try to work some of the examples on p. 61, H.S., *or* Exs. 5 to 13, p. 31, in 'Loney,' *or* Exs. XVII. in 'Lock.' In each of these examples you should draw a right-angled triangle and attach the numbers to the sides.

Stage 3.

Algebra.—Some types of Equations.

1. $4x - 3y = 1$.
$12x^2 + 13y^2 = 25$. Ans. $x = 1, -\frac{83}{58}$; $y = 1, -\frac{25}{29}$.

In this type one of the equations is linear; that is, it contains terms in x and y to the *first* power only. In such a case you may substitute for x or y from the first equation into the second.

2. $3x^2 - 5y^2 = 7$.
$3xy - 4y^2 = 2$. Ans. $x = +2, +3$; $y = +1, +2$.

In this type each equation is homogeneous; that is, each term in x or y has the same dimensions—two in this case. Put $x = my$, and solve for m.

3. $x^2 - 4xy + 3y^2 = 0$.
$2x^2 - 2x + y = 13$.
Ans. $x = 3, -2\frac{1}{4}$, or $\frac{1}{4}(1 \pm \sqrt{105})$;
$y = 1, -1\frac{3}{4}$, or $\frac{1}{2}(1 \pm \sqrt{105})$.

In this type one equation contains nothing but terms of the second degree; it is, therefore, a quadratic to determine $\frac{x}{y}$ or $\frac{y}{x}$. For, divide through by y^2 and it becomes $\left(\frac{x}{y}\right)^2 - 4\frac{x}{y} + 3 = 0$. Solve this, and proceed as in (1).

4. $x + y + z = 1$,
$3x - 2y + 2z = 2$,
$x^2 + 2y^2 + x + z = 1$.
Ans. $x = 0$ or $\frac{9}{5}$; $y = 0$ or $\frac{1}{18}$; $z = 1$ or $1\frac{3}{5}$.

In this type there are two linear equations and one of the second degree. Find x in terms of z, and y in terms of z, and substitute these into the third equation. The student will readily see that it is a simple matter to find an equation which shall not contain a particular one of the letters x, y, z, say y. For, multiply the first by 2, and add to the second, y will disappear and x will be expressed in terms of z.

There are a great number of types of equations, but there are a few types with which a student ought to be quite familiar.

A few examples may be worked from H. K. Exs. X.b, while the worked out examples in Art. 137 should be carefully read, and others worked from Exs. X.c.

Solve—

$$\left.\begin{matrix} x - y = 1 \\ 2x + 3y + z = 8 \\ x^2 + y + z = 6 \end{matrix}\right\} \qquad \left.\begin{matrix} 3x + y - 2z = 0 \\ 4x - y - 3z = 0 \\ x^3 + y^3 + z^3 = 467 \end{matrix}\right\}$$

Ans. $x = 2$, $y = 1$, $z = 1$; $x = 5$, $y = -1$, $z = 7$.

Trigonometry.—Before entering on new ground, there is much hard work to be done at the elementary trigonometry. There is no section of the syllabus with regard to which it is a greater advantage to know thoroughly the elementary work than is the case with the trigonometry.

The student may start with Chaps. VII. and VIII., 'Loney,' or Chaps. XI. and XII., 'Lock,' or Chap. VI. Tod., and *work hard for a month* at the examples in these chapters.

Perhaps it will be well to speak clearly with regard to the degree of proficiency which is desirable in connection with this part of the subject. It is not a very difficult task to learn the four formulæ for $\sin(A \pm B)$ and $\cos(A \pm B)$; these are fundamental. From these four there are easily deduced four others, which enable us to add or subtract sines or to add or subtract cosines. The student should derive the latter four from the former, and he ought to do this until he is tired of it and can do without it.

We will take one or two examples. A student is asked to prove that $\cos 2A + \cos 2B = 2\cos(A + B).\cos(A - B)$. Well, if he knows the formula he will readily do this. Now what we desire that he shall be able to do is this: if he, at any time in working any example, finds the expression $\cos(A + B).\cos(A - B)$, he shall be *ready* (on his own account, without being specially asked) to put $\frac{1}{2}(\cos 2A + \cos 2B)$. It will take a little time to be able to do this, but it may be done by the student who will take the trouble to write down for himself thirty or forty such expressions as $\sin 20°.\sin 40°$, $\cos 2A.\sin 4\theta$, $2\sin\frac{\pi}{2^n}.\cos\frac{\pi}{2^{n+2}}$, $\cos(n+1)A.\cos(n-1)A$, and each time write down the equivalent.

If the student has not already done so, he will learn the formula $\cos 2A = 2\cos^2 A - 1$, or $\cos 2A = 1 - 2\sin^2 A$, but he must not adhere to this form of it only. It is just as important to know that

$$\cos^2 A = \frac{1 + \cos 2A}{2}, \text{ or that } 1 - \cos 2A = 2\sin^2 A.$$

He must be able to twist these about in every possible way, and not to adhere so much to the 2A and A in the formulæ, that he fails to see at a glance that

$$\cos\frac{\pi}{2^n} = 2\cos^2\frac{\pi}{2^{n+1}} - 1$$

$$\text{or that } 2\cos^2\frac{A}{20} = 1 + \cos\frac{A}{10}.$$

The formulæ enable us at any time to express the cosine of an angle in terms of the (sine)^2 or (cosine)^2 of the *half* angle, or to express the (cosine)^2 or (sine)^2 of an angle in terms of the cosine of the *double* angle; this is really the proper light in which to regard the formulæ.

To the student who is encountering these formulæ for the first time, the above remarks will convey little meaning. If he first reads over the chapters above named he will probably, however, catch our meaning.

NOTES ON THEORETICAL MECHANICS.

BY F. CASTLE, M.I.M.E.

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ADVANCED AND HONOURS STAGES.

(*Continued from page* 654.)

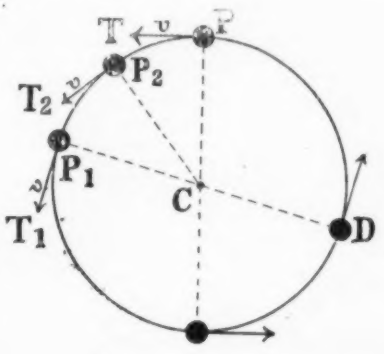
The following definition of 'hodograph' will be found useful:—If a body move in any path, and if from any fixed point lines be drawn representing at any instant its velocity in direction and magnitude, the extremities of these lines form a curve which is called the *hodograph* of the motion.

Uniform Circular Motion.

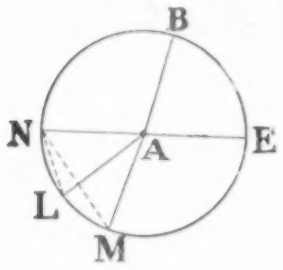
Let a particle P describe a circle centre C, and radius r, with uniform velocity v; to find the magnitude and direction of the acceleration.

When at P the velocity is in the direction of the tangent PT, and at P_2 in the direction P_2T_2.

From any convenient point A draw AN equal in magnitude to v and parallel to PT, also AM equal to v and parallel to P_1T_1.



The velocity of the moving particle is unaltered in passing from P to P_1, but the direction is changed from AN to AM, and the acceleration to produce this change in the direction



may be shown roughly by a line joining M to N. Taking any point P_2 between P and P_1 and drawing AL parallel to the tangent at P_2 then the line NL would give a better approximation to the acceleration necessary to change the direction from PT to P_2T_2.

As the velocity of P is constant, all the lines AN, AM, etc., are equal in length, and the *hodograph* NMEB is a circle centre A, and radius v units.

If a very short interval of time be taken, the point on the circle will be very near to P and the corresponding point on the hodograph very close to N. In the limit when the point is indefinitely near to P, the line NL becomes the tangent at N; *the direction of the acceleration is therefore from* P *towards the centre of the circle.*

Let t denote the time taken by the moving point for one revolution, then the acceleration (or rate of change)

$$f = \frac{2\pi v}{t} \quad (1).$$

The space described in one revolution is $2\pi r$.

$$\therefore t = \frac{2\pi r}{v}, \quad (2).$$

Substituting the value of t from Eq. (2) in Eq. (1) and we obtain

$$f = \frac{v^2}{r} \quad (3).$$

Thus when a particle (or body whose mass may be supposed to be collected at a point) moves uniformly in a horizontal circle of radius r with velocity v, *the radial acceleration is directly proportional to the square of the speed, and inversely proportional to radius.*

The force F (in poundals) towards the centre of a circle in which a mass m is moving, is found by multiplying both sides of (3) by m, and is

$$F = mf = \frac{mv^2}{r} = m\omega^2 r,$$

where ω denotes the angular velocity.

To obtain F in lbs. weight it is only necessary to divide by g;

$$\therefore \frac{mv^2}{gr} = F \text{ lbs.}$$

When the motion takes place in a vertical circle the force of gravity will affect the result, increasing or diminishing the magnitude at every successive position of the moving body.

Ex. 1.—A particle of given mass moves with a given velocity in a circle of given radius; state what is known as to the force which acts on the particle. Prove the statement. If the radius be 3 ft., the mass 12 lbs., and the velocity 40 ft. per sec., find the force ($g = 32$). (1896.) Ans. 6400 poundals.

Ex. 2.—A particle describes a circle with a constant velocity; show that the force acting upon it is always directed to the centre, and find the magnitude of the force in terms of the radius of the circle, and the mass and velocity of the particle.

A particle whose mass is 10 lbs. is constrained to move in a horizontal circle by a string 5 ft. long fastened to a fixed point; if at any instant the tension of the string is 98 poundals, find the velocity of the particle, and its angular velocity about the fixed point. (1892.) Ans. 7 ft.; 1·4 radians.

(Solution.—$F = \frac{mv^2}{r}$ $\therefore 98 = \frac{10v^2}{5}$ gives $v = 7$;

angular velocity $= \frac{v}{r} = \frac{7}{5} = 1{\cdot}4$ radians.)

Ex. 3. A particle of given mass (M) moves with a constant velocity (V) in a circle of given radius (r); state what is known as to the force (F) which acts upon the body.

If a force equal to F makes a particle of mass M move in a straight line, through what distance must it act to give a velocity V; F, M, and V being the same as in the first part of the question. (1895). Ans. $\frac{r}{2}$.

$\left(F \times \text{dist.} = \frac{1}{2} MV^2 \text{ and } F = \frac{MV^2}{r}. \quad \therefore \text{dist.} = \frac{r}{2}.\right)$

Ex. 4. A train of 60 tons weight is rounding a curve of radius 500 yards at 30 miles per hour; find the horizontal pressure on the rails. Ans. 2·42 tons.

(30 miles per hour = 44 ft. per sec.

$$\therefore \text{press.} = \frac{w \times 44^2}{g\,r} = 2{\cdot}42.)$$

To balance the horizontal pressure the elevation of the outer rail is such that the resultant of the centrifugal force and gravity act in a direction at right angles to the plane of the surface of the rails.

When a particle of mass m moves uniformly in a vertical circle of radius r, with velocity v, the pull on the centre in poundals would at the lowest point be

$$\left(\frac{mv^2}{r} + mg\right),$$

and at the highest point

$$\left(\frac{mv^2}{r} - mg\right).$$

Ex. 5. A body of mass 24 lbs. is moving in a vertical circle whose radius is 3 ft.—the velocity is 21 ft. per second; find the tension in the string connecting the body to the centre at (*a*) the highest and at (*b*) the lowest point of the circle ($g = 32$).

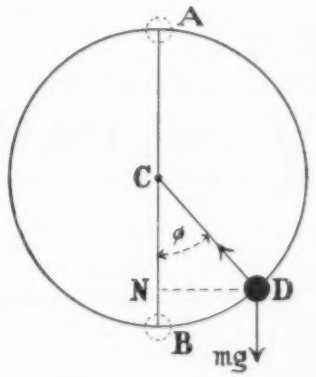
$$\text{Centrifugal force in lbs} = \frac{24 \times 21^2}{32 \times 3} = 110\tfrac{1}{4} \text{ lbs.}$$

(*a*) Pull in string when at B $= 110\frac{1}{4} + 24 = 134\frac{1}{4}$ lbs.

(*b*) ,, ,, ,, A $= 110\frac{1}{4} - 24 = 76\frac{1}{4}$ lbs.

To find the least tension in the string connecting a mass D to the centre of a vertical circle, also the least velocity that D may have.

Let v be the velocity of the particle at D, r the radius of the circle BC, and T the tension of the string CD.



The acceleration along DC is equal to $\frac{v^2}{r}$ and the force along

$$DC = \frac{mv^2}{r}.$$

The other forces acting on the mass D, are mg its weight, and T the tension in the string.

If ϕ denote the angle DCB, then

$$T - mg\cos\phi = \frac{mv^2}{r}, \text{ but } v^2 = V^2 - 2gs;$$

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V being the velocity of P when passing the lowest point B, and S the distance BN. Substituting

$$T - mg\cos\phi = \frac{m}{r}(V^2 - 2gs),$$

$$\text{also } \cos\phi = \frac{CN}{CD} = \frac{r-s}{r}.$$

$$\therefore T = mg\frac{r-s}{r} + \frac{m}{r}(V^2 - 2gs)$$

$$T = \frac{m}{r}(V^2 + gr - 3gs). \quad (1)$$

From Eq. (1), the tension of the string when the particle is at any given height s above B can easily be calculated.

The body will just make a complete revolution when the tension of the string at the highest point A is zero, $\therefore s$ is equal to $2r$; hence from Eq. (1),

$$0 = \frac{m}{r}(V^2 + gr - 3g \times 2r),$$

$$\text{or } V^2 = 5gr.$$

$$\therefore V = \sqrt{5gr};$$

also the tension at the lowest point B will be found from Eq. (1) by putting $S = 0$ and $V = \sqrt{5gr}$.

$$\therefore T = \frac{m}{r}(5gr + gr) = \underline{6mg}.$$

Ex. 6. (*a*) A body is tied to a string and is whirled round in a vertical circle; find the least velocity it can have at the lowest point if it is to describe the whole circle.

(*b*) If the mass of the body is 12 lbs, and the length of the string 6 ft., find the tension of the string at the lowest point if the body just stays in the circle.

(*c*) In what units is your answer expressed? ($g = 32$.) (1894).

Ans. (*a*) $V = \sqrt{5gr}$. (*b*) 72 lbs. (*c*) gravitational.

LIST OF BOOKS RECOMMENDED FOR THEORETICAL MECHANICS.

Adv. Solids.—'Elements of Dynamics,' by Loney, 3s. 6d.; 'Elementary Dynamics,' by Loney, 7s. 6d. (Cambridge University Press); 'Elementary Dynamics,' by Hicks (Macmillan).

Adv. Fluids.—'Hydrostatics and Pneumatics,' by Pinkerton (Blackie); 'Elementary Hydrostatics,' by Besant (Deighton, Bell and Co.)

For both Solids and Fluids.—'Elementary Mechanics,' by Ziwet, 3 vols., 8s. 6d. per vol. (Macmillan).

Honours.—'Dynamics,' by Williamson and Tarleton (Longmans); 'Statics,' by Minchin, 2 vols; 'Hydrostatics and Elementary Hydrokinetics,' by Minchin (Clarendon Press).

For Reference.—'Theoretical Mechanics' and 'Practical Mechanics,' by Twisden (Longmans).

REPLIES TO SCIENCE QUERIES.

Nit.—A gallon of water weighs 10 lbs., therefore $\frac{3}{180}$ of $\frac{10}{8} \times 16$ gives the answer required in ounces.

J. A., Durham.—If you wish to take Section I. of the Syllabus, you will find a list of apparatus required in Cartwright's Section 'I. 'Physiography.' If you wish to take the Elementary stage completely, you will find a list of necessary apparatus in the 'Science Directory.' As the new Directory at time of writing is not issued, I cannot give you a detailed list. You would be able to get your apparatus most cheaply at Gallerhamp's, Cross Street, Finsbury Pavement, E.C., who will also tell the price of the apparatus quoted in the Directory if you write to him as soon as the Directory is issued.

Integer.—Professor Glazebrook's name is sufficient to warrant that his book on 'Light and Heat' may be thoroughly relied on. It would probably cover the greater part of the S.K. syllabus, but the student must carefully prepare himself so as to be able to work out simple numerical examples. Draper's 'Heat' is perhaps the most satisfactory book on the market, and that with Emtage's 'Light' would be the books we would recommend. Read these or Glazebrook's book, and then try working the questions set during the last three years, sending us any that you are unable to manage, to be answered in Query Column.

Books on Hygiene:—(*a*) *Elementary*, Reynold's 'Hygiene for Beginners' (Macmillan). (*b*) *Advanced*, News Holme's 'Hygiene.'

Special Reproductions in connection with our Amateur Photographic Competition will appear next month.

SCIENCE NOTES.

THE NEW SUGAR.—A new sugar has been produced by the hydrolysis of caroutin by dilute acids. It has been given the name of caroubinose, and is a syrupy, non-crystalline body soluble in water and in alcohol. It has the formula $C_6H_{12}O_6$.

***

A NEW FERMENT.—Effront has succeeded in the course of his examination of the products of the fruits of *Ceratonia siliqua* in isolating a new zymose, caroubinose, which is developed during the germination of the seeds of the locust bean. This ferment acts energetically on caroubin, liquefying gelatinous solutions of that carbohydrate. It seems to be most active at between 40° C. and 50° C. It is destroyed at 80° C. Its liquefying power is increased by a trace of formic acid. From the action of the ferment on the caroubin jelly there results a liquid rich in a reducing sugar precipitated by alcohol and soluble in water, the solution being strongly dextro rotatory.

***

ANIMAL CHARCOAL AND OXIDISATION.—Dupuoy shows the oxidising power of animal charcoal by adding a few grains of that substance to a few c.c. of fresh guaiacum. Immediately an intense blue colouration is produced in the cold. Wood charcoal does not give this reaction. Probably the beneficial effect of animal charcoal on ulcerations and granular wounds is due to this oxidising power.

***

INK AND MICROBES.—Herr Marpmann, of Leipzig, after examining 77 samples of the ink used in schools, is of opinion that there are microbes in ink, and that it is dangerous to prick the skin with a pen. Most of the inks he examined were made with nutgalls containing micro-organisms, even red, blue, and nigrosine inks containing them. A bacillus cultivated from nigrosine ink killed a mouse by inoculation.

***

A NEW PLANT PROTECTOR.—A plant protector has lately been invented which may possibly do away with the use of hothouses and hotbeds. The plant is covered with an inverted funnel or glass. The open spout of the funnel in the air is covered with a lid, and this is opened or closed according to the temperature by means of a spiral spring which expands or contracts with cold after the manner of Breguet's metallic thermometer.

***

CONSUMPTION AND THE RÖNTGEN RAYS.—Bergonié and Mongour, from some recent investigations undertaken by them, are of opinion that the X-rays to some extent enable the lungs to struggle against the Koch bacillus. They applied the rays to the chests of five patients. In two cases of acute phthisis which was aggravated by alcoholism and privation there was no effect. On the other hand, in two out of three cases of chronic tuberculosis their result seems to have been beneficial. In one instance a local and general amelioration lasted for six weeks, and in another an immediate improvement took place in the general state without any modification of local condition. A case of acute tuberculosis treated by Drs. Chanteloupe, Descompt, and Rouilliès was also successful. After 30 applications of the X-rays, nine in front and 21 at the back of the lungs, the patient had almost recovered. No medicine was given.

***

A NEW METHOD OF COLOURING GLASS.—M. Léon Lémal has invented a new method of colouring class by covering it with a silver salt, and heating it to 500 degrees centigrade. Pretty decorations can be obtained by this process. The glass is found to be tinged as soon as it becomes cool. It is yellow when seen by light passing through it, and blue when seen by reflected light. Salts of gold, iron, copper, and other metals also stain glass in this way.

***

SUBMARINE PLUNGERS.—M. Bazin has recently investigated the galleons of Vigo by means of submarine plungers, which can be lowered to great depths for observation of the sea-bottom. The 'Travailleur sousmarin' of Signor Piatti del Pozzo, which is nearly spherical and built of ribbed metal, is intended to go down 1,500 feet, where the pressure of water is about 750 lbs. on the square inch. It is equipped with levers, grapnels, and other tools which can be worked from the interior. Portholes enable the operator to see what is around him, and the interior is illuminated by electricity. The diver can speak with the ship, or shore above, by telephone. Powerful submarine sealights to illuminate the sea-bottom can be worked from above. Should the chain part, the plunger rises to the surface.

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OUR COMPETITION PAGE

OUR FRENCH PRIZE COMPETITION.

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RESULT OF THE SEPTEMBER COMPETITION.

The prize is awarded to 'Factotum,' the pseudonym of Charles Lawrence Ford, B.A., 3, Sydney Buildings, Bathwick Hill, Bath.

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Second Class.—Tiro, Gretula, A.E.B., N'importe, La Roche, Sursum corda, Trcherbert, Nimoise, (A paper unnamed,) Striver, Girot, Stour, Maid-Marian, Maree, August, Félicité, Yllop, Milly, Peggy, Auld Reekie, Kish, Wessex, B.Sc., Rosebud, Nortoniensis, Venus, Agricola, Hazard warily, Beatrice, Le bonheur, La chèvre, Etna, Legeolium, Perabolus, Vera, Rouge, Stansfield, Montreux, Blue Bar, L.J.Z., Bernardine, Heath, L'écolière, Salopia, Henri R., Windyraw, Orphir, Veronica, Romola, Coming, Docendo discimus.

Third Class.—Cesarea, Adwick, Kenilworth, L'éclair, Sam, Alastor, Margaret, Vera, Celandine, E.W.S., Alice, Sanda, Vernon, Egerton.

Le musicien était un jeune homme plein de feu, une de ces organisations puissantes que vous reconnaissez tout d'abord à je ne sais quels signes certains ; l'œil qui brille sous sa paupière noire, les cheveux longs et souples, tant ils ont été tourmentés par une main distraite. Le poëte, tout au rebours : c'était un illustre faiseur d'opéras-comiques, qui avait son entrée chez M. Auber et chez M. Scribe ; il était frais de visage, bien portant, heureux. Content de lui-même, content des autres, il espérait sans trop d'angoisses le fauteuil de l'Institut, soutenu qu'il était dans cet espoir par tant de nominations récentes ; il se croyait aussi grand que M. Meyerbeer ou tout autre grand musicien ; il se souriait à lui-même, au dedans et au dehors ; il se disait tout bas : *La musique, c'est moi !* et, pour peu qu'on l'en eût prié, il l'eût dit aux autres. Bref, c'était un homme heureux dans toute la force de cette belle, et heureuse, et poétique expression : *le bonheur!* D'ailleurs, c'était un homme très habile à trouver quand il voulait, et toutes les fois qu'il en avait besoin, toutes sortes de pointes, jeux d'esprit, calembours, scènes, entrées, sorties et autres ingrédients du drame lyrique ; il faisait le couplet à boire aussi bien que la tendre romance ; il excellait dans le dialogue ; il écrivait à ravir le grand air du récitatif ; il avait un talent tout particulier pour la ronde pastorale, il entendait le couplet final à merveille ; pour le chant patriotique, pour l'épigramme rimée, notre homme ne le cédait même pas à Béranger ; il produisait des vers bons à mettre en musique, aussi facilement et aussi naturellement que les pommiers de Normandie produisent la pomme à cidre. J. JANIN.

Translation.

The musician was a young man full of fiery ardour, one of those whose very structure indicates a hidden power, and whom you recognize at a glance by certain indescribable and yet clearly marked signs ; the eye glittering underneath its dark lid, the hair long and supple, twirled so oft as it has been by the hand in some moment of abstraction. The poet, altogether the reverse ; he was a celebrated composer of comic operas, who had free admission to M. Auber and M. Scribe ; he was of florid complexion, hale, happy. On good terms with himself, on good terms with others, he was looking forward in hope and without overmuch anxiety, to a seat in the Institute, supported as he was in this hope by so many recent nominations ; he thought himself quite equal to M. Meyerbeer or any other great musician ; he smiled graciously on himself, both with inward complacence and outward expression ; his murmured soliloquy ever was, 'Music, that is myself!' and, at the slightest hint in the way of a request, he would have said so to others. In short he was one of those men happy in the full import of that beautiful, felicitous, and poetical phrase 'Good fortune!' Moreover he was a man well able to find when he wished, and on every occasion when he had need of them, all sorts of smart turns, witticisms, puns, situations, entries, exits, and other constituent parts of the lyric drama ; he would dash off a drinking song as exquisitely as a tender love-ditty ; dialogue was his *forte ;* he wrote to admiration the grand air of the recitative ; he had a quite peculiar talent for the pastoral roundelay, understanding the closing couplet to a miracle ; as for the patriotic ballad, the rhymed epigram, our poet did not yield the palm even to Béranger ; in fact he produced verses fit to be set to music, as easily and as naturally as the Normandy apple trees produce apples fit for cider. FACTOTUM.

A very large number of competitors entered, and the quality of the papers exhibits that steady progress which we have before remarked. The number of competitors who content themselves with merely transcribing dictionary meanings of words and phrases, thereby producing the effect of a mosaic made of particularly ill-fitting fragments, gradually diminishes.

Organisations was curiously translated 'organisms' by several competitors, and 'organisers' by one.

'*Je ne sais quels*' proved, as might be expected, a trial to some. Its meaning is 'vague,' 'indefinable.'

Le poëte, tout au rebours was troublesome from its conciseness. Some translated '*tout au rebours*' as 'all awry,' or 'against the grain.'

Un illustre faiseur d'opéras-comiques was translated by one candidate as 'an imminent writer,' etc., and by another as 'an illustrious swindler of comic operas.'

Avait son entrée chez was mistranslated by a great many, and the successful candidate has given rather an awkward rendering of it. It means 'was on intimate or visiting terms with.'

Le fauteuil de l'Institut was understood by many to mean the Presidency of the Institute or a professorship at the Institute.

Au dedans et au dehors was rendered by several as 'at home and abroad,' instead of 'inwardly and outwardly.' One competitor translates *Il se souriait à lui même* as 'He sneered at them to himself.'

Pour peu qu'on, etc., was a difficulty, some candidates overlooking the fact of this sentence being hypothetic, One has it, 'And when anyone asked him for ever so little, he let the rest have it.'

Il se disait tout bas is rendered by one candidate as 'whispering softly *in his own ear.*'

Il faisait le couplet à boire is cruelly treated by several candidates. 'He made the drunken couplet'; 'he made the stanza drink'; 'he absorbed the song'; 'he composed verse to commit to memory'; 'he drank verse as well as the tender romance,' may suffice for specimens.

Le grand air du récitatif appears on one paper as 'the grand rollicking air.'

Il avait un talent tout particulier pour la ronde pastorale appears on one paper as 'He had quite a singular talent for the clerical sphere.'

Il entendait le couplet final à merveille has two singular renderings. 'He heard excellently well all his life,' is the less singular of the two. 'For long had he suffered from the loss of a hand,' is utterly incomprehensible.

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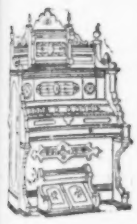

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défiance et l'égoïsme, résultats des révolutions, avaient tué l'amabilité et les réceptions hospitalières. On s'inquiétait fort peu de l'inviter, la simple jeune fille, car elle ne pouvait offrir des amis qui obtinssent une radiation de la liste des émigrés, ou une protection auprès du premier consul, déjà bien grand, déjà bien respectable pour des gens à instinct monarchique. De voisins tels que nous les connaissons, il n'y en avait pas. La noblesse, décimée par la Terreur et par l'émigration, contrainte à se transformer de toutes manières pour échapper à l'attention, était partout, excepté dans ses manoirs. La chouannerie, dont le flot était venu mourir aux limites de ce pays, n'aurait pas offert aux nobles compromis ou non, dans ces contrées, l'appui d'une force morale suffisante pour leur permettre de prendre une attitude imposante vis-à-vis de l'autorité ; son existence passée les compromettait sans les pouvoir protéger. Plusieurs générations étaient à la vérité déjà sorties de la bourgeoisie pour dépasser en talent la noblesse comme pour la remplacer en générosité, mais tous ces pauvres du tiers état étaient dans les camps à se battre ou occupés au centre de l'administration à moissonner réputation et fortune. Chaque province s'était donc appauvrie pour payer à l'Etat son tribut de génie. Sophie et probablement beaucoup d'autres femmes de cette région restaient donc seules comme les filles de ce roi grec quand tous les hommes furent allés à la guerre de Troie. J. JANIN.

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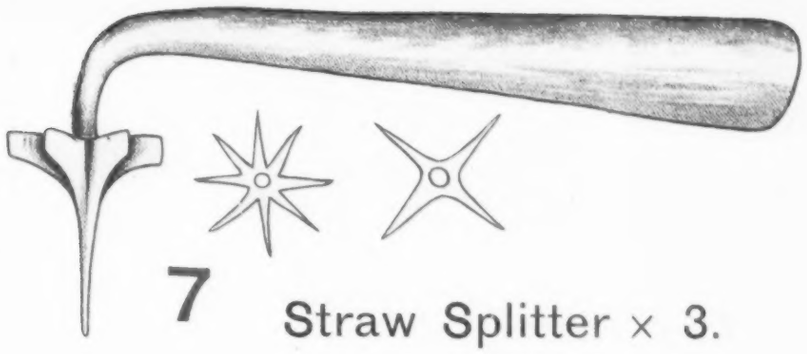

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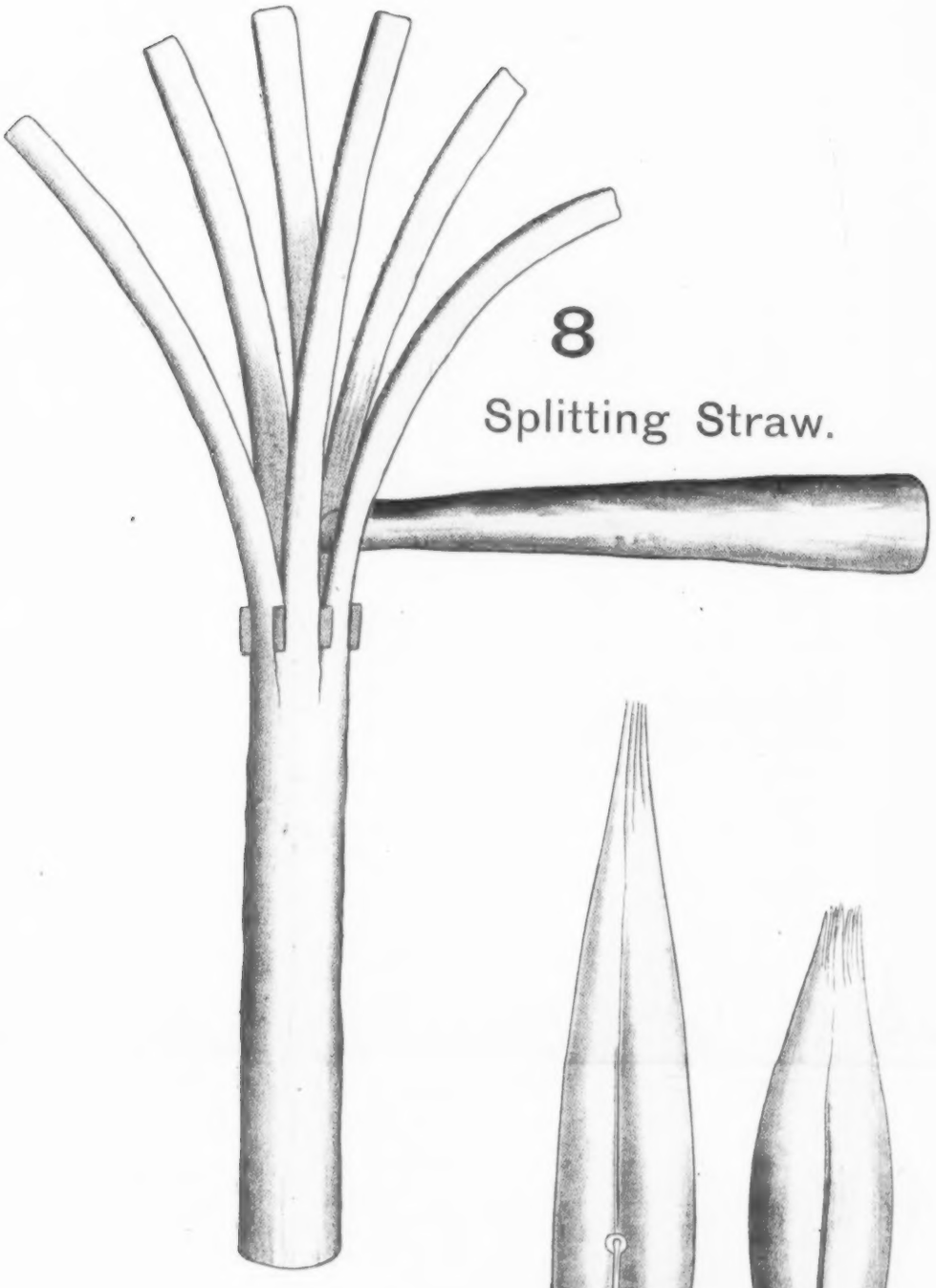

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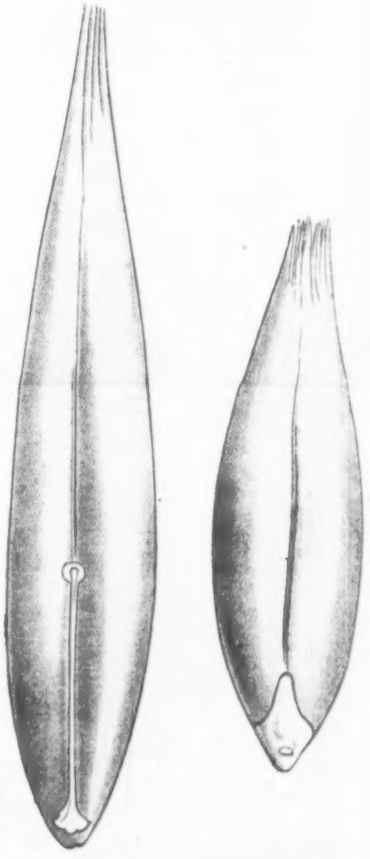

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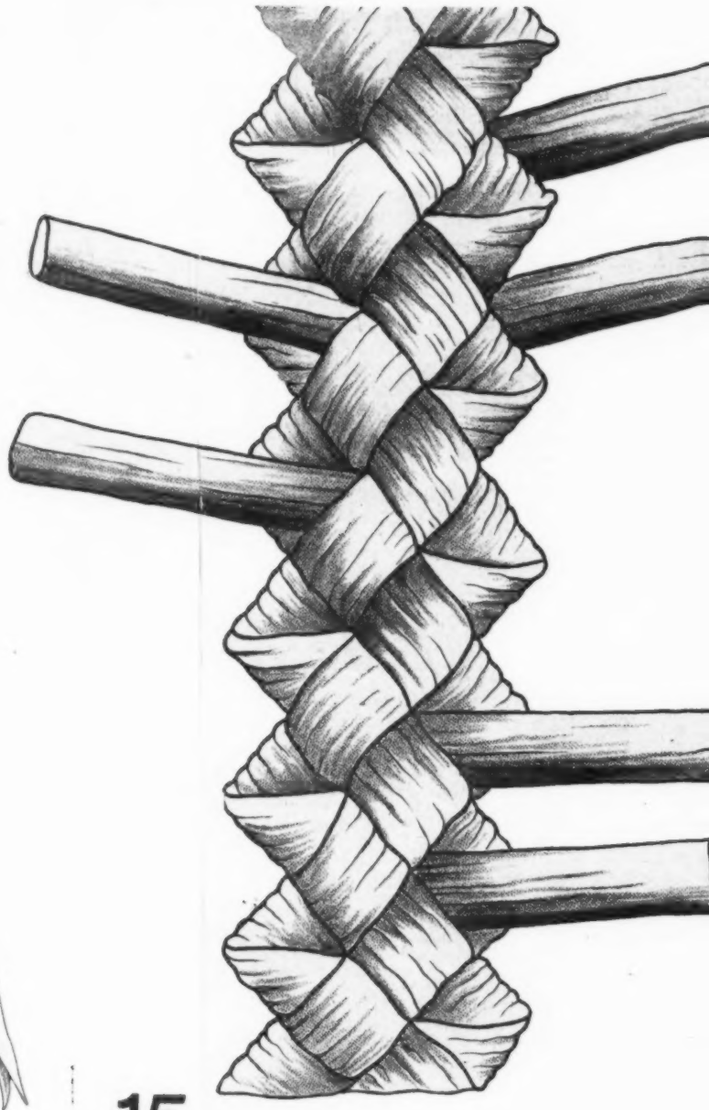

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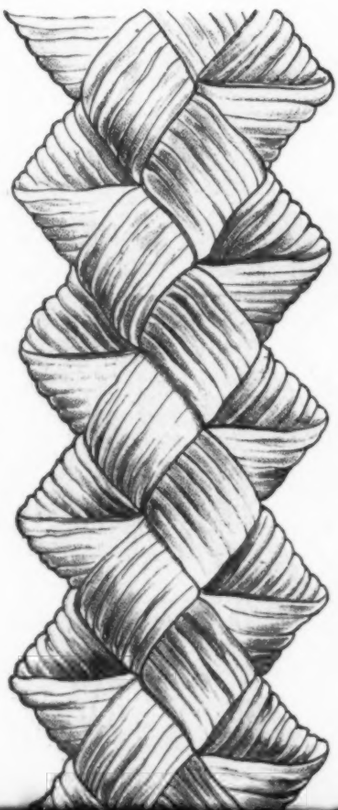

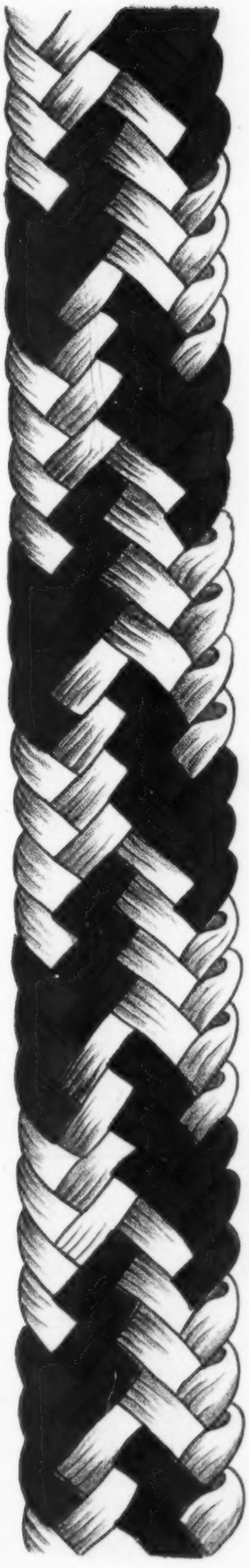

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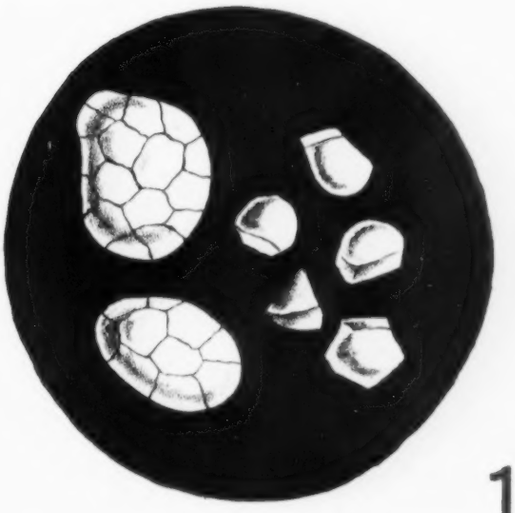

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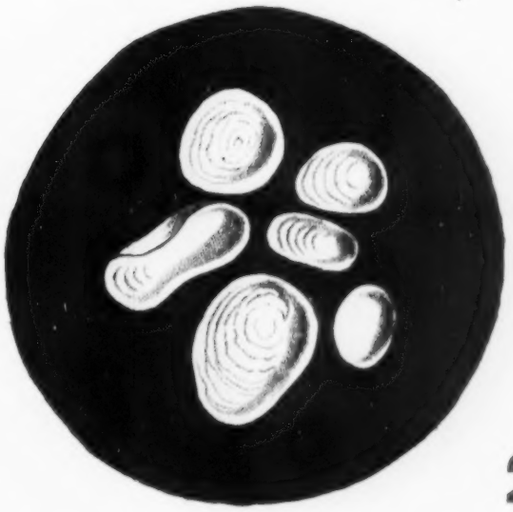

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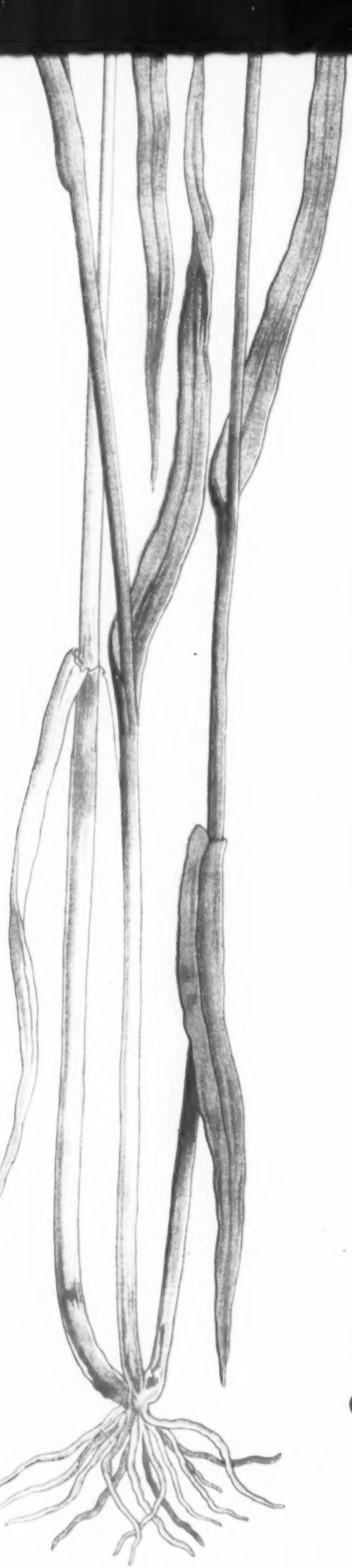

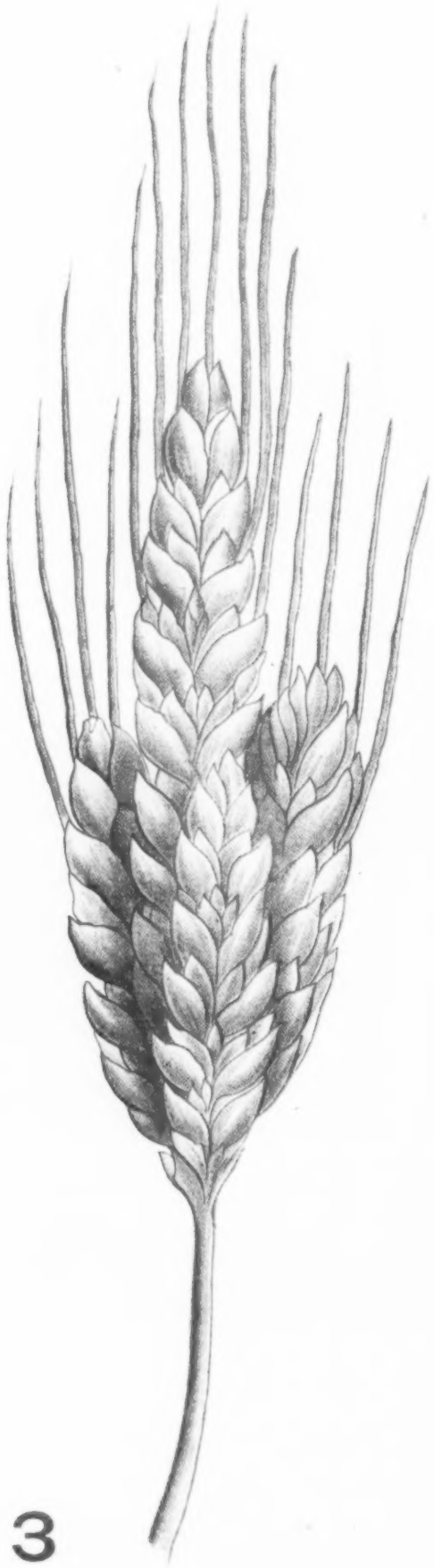

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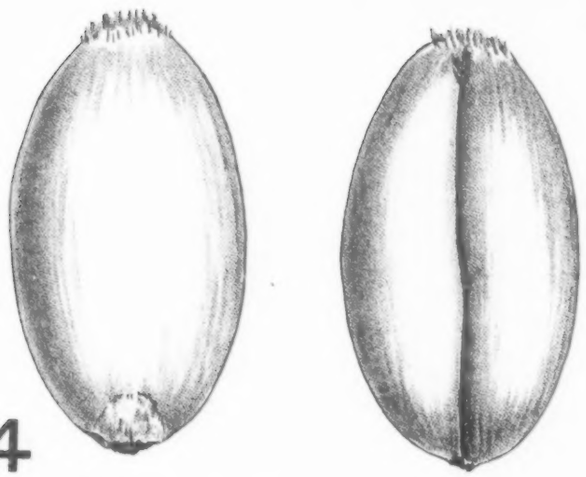

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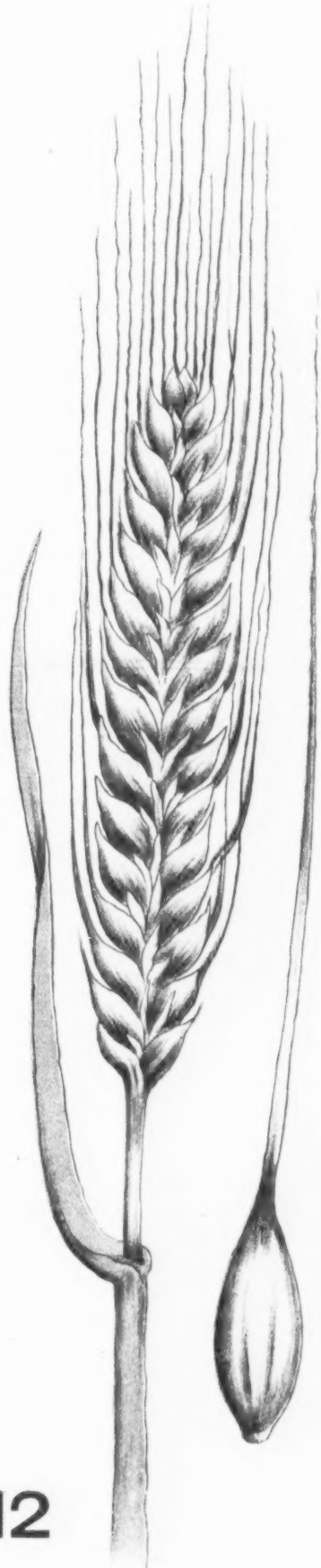

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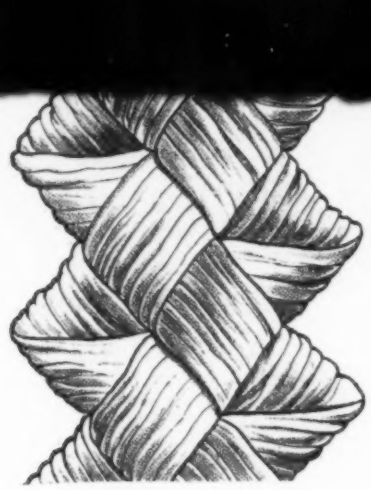

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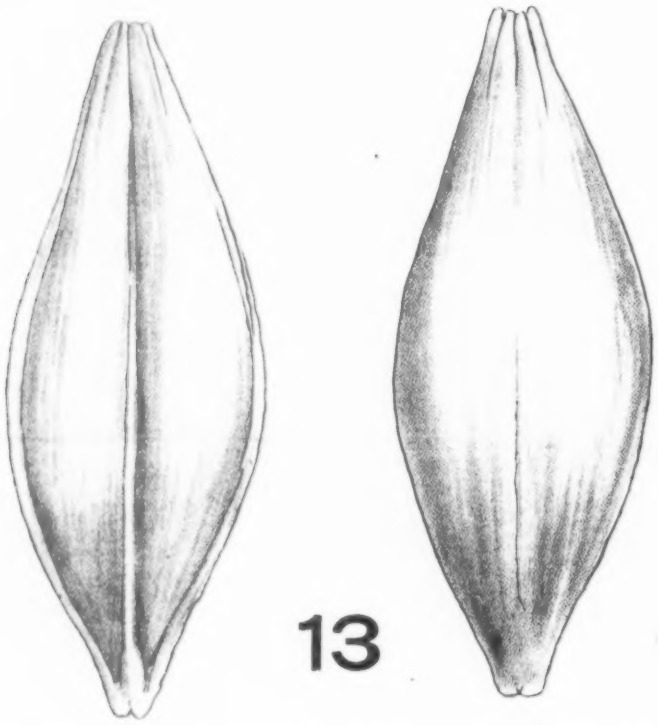

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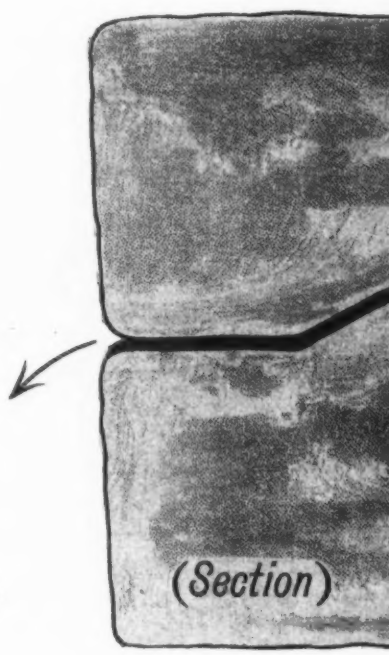
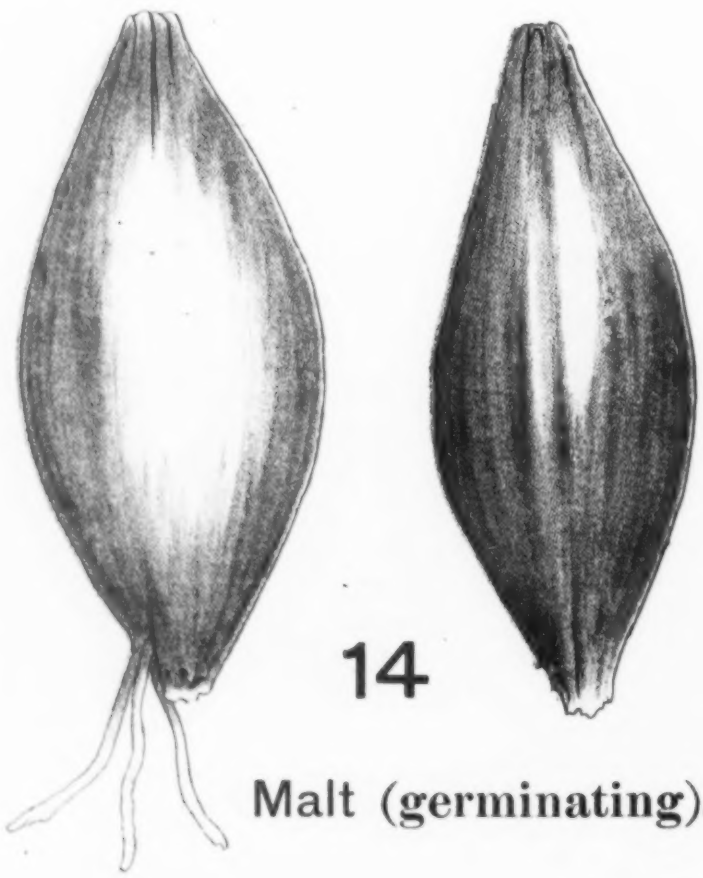


Ancient



14

Malt (**germinating**).

are),

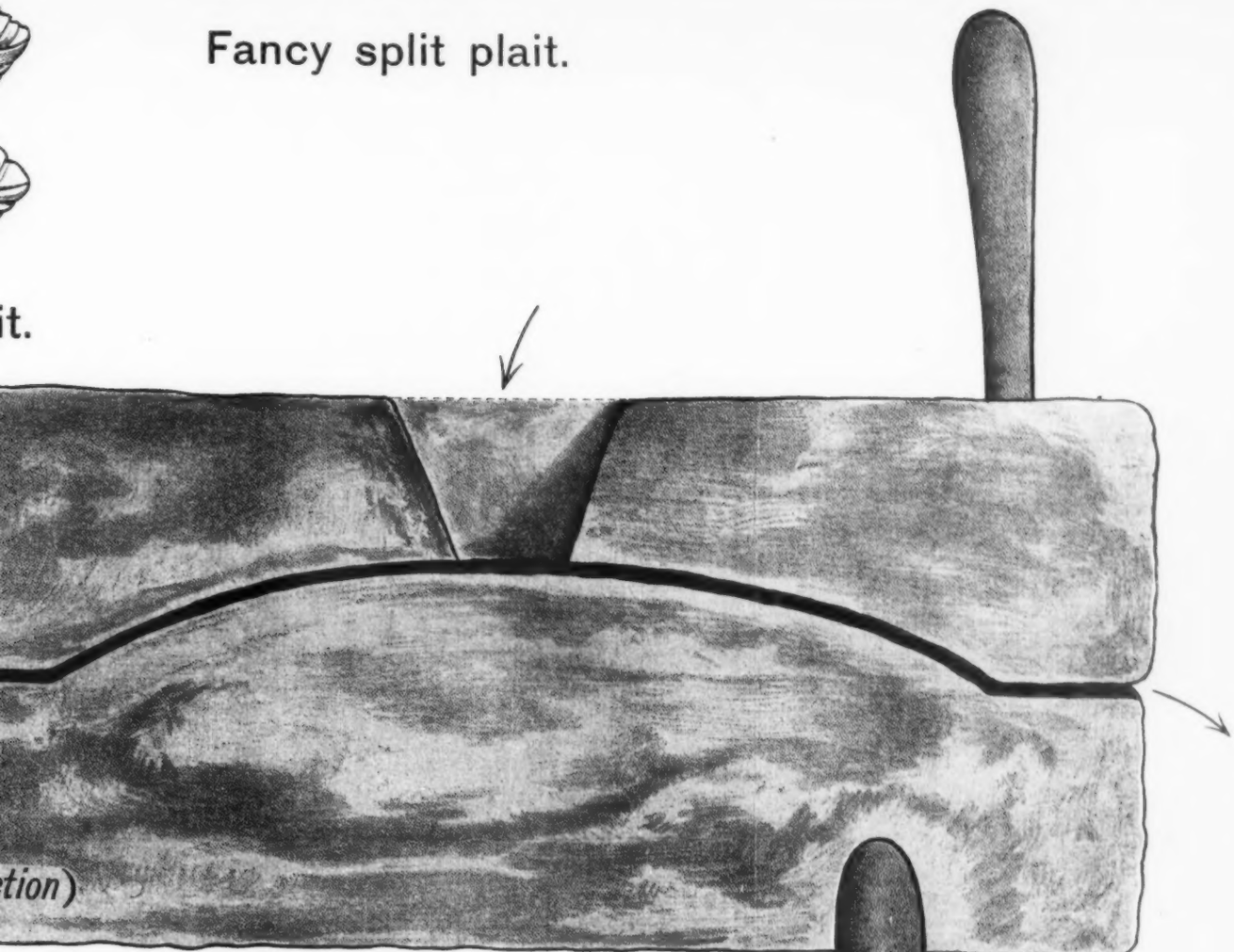
TS, & BARLEY.

17

Barley Starch × 1000.

Fancy split plait.

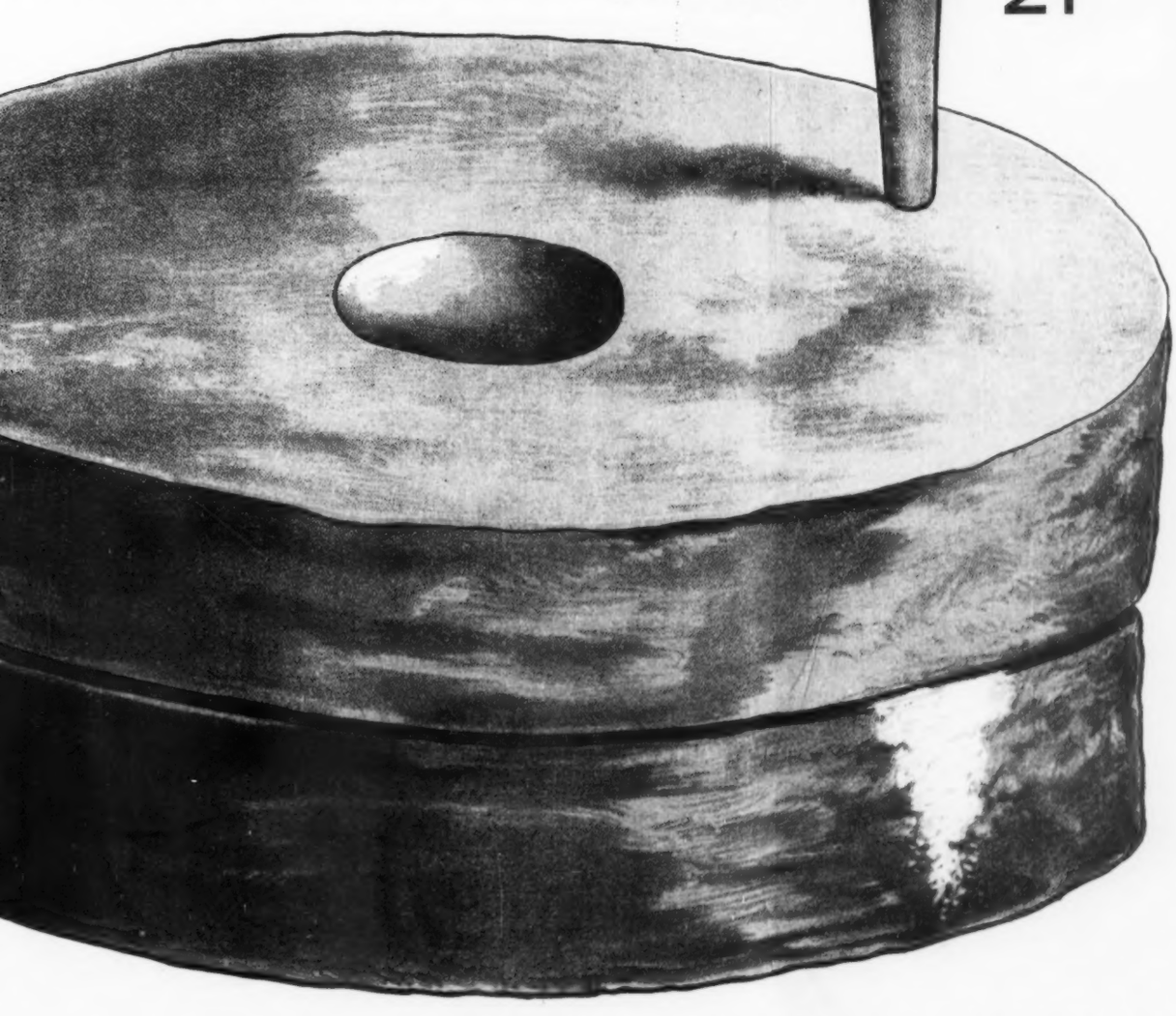
it.



tion)

ncient Domestic Corn-Mill (reduced).

21



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